DOCUMENT RESUME

ED 390 647 SE 056 939

AUTHOR	Strickler, Mervin K., Jr.
TITLE	Federal Aviation Administration Curriculum Guide for Aviation Magnet Schools Programs.
INSTITUTION	Federal Aviation Administration (DOT), Washington, D.C.
REPORT NO	AHT-100-1-94
PUB DATE	[94]
NOTE	558p.
PUB TYPE	Guides - Classroom Use - Teaching Guides (For Teacher) (052)
EDRS PRICE	MF02/PC23 Plus Postage.
DESCRIPTORS	Air Transportation; *Aviation Education; Curriculum Guides; Elementary Secondary Education; *Magnet Schools; Science Activities; Technology

ABSTRACT

The Federal Aviation Administration (FAA) and its predecessor organizations, Civil Aeronautics Agency (CAA) and the Civil Aeronautics Administration (CAA) have pioneered the use of aviation education in working with schools and colleges of the nation to attain their objectives. This publication includes: a brief history of the role of aviation in motivating young people to learn; examples of aviation magnet activities, programs, projects, and school curricula; documentation of the benefits of aviation education for students; examples of what one person can do to facilitate aviation magnet education activities, projects, programs, and curricula; curricular and program models for use, adaptation, or modification; identification of resources for planning a program of aviation education; information about and examples of curricula to prepare for the many career opportunities in aviation and transportation; and guidelines and information for FAA aviation education counselors. (JRH)

****
*   Reproductions supplied by EDRS are the best that can be made   *
*   from the original document.   *
****

S. Department
f Transportation
ederal Aviation
dministration

ED 390 647

FAA Headquarters
Aviation Education Division

Federal Aviation Administration Curriculum Guide for Aviation Magnet Schools Programs

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☑ This document has been reproduced as received from the person or organization originating it
☐ Minor changes have been made to improve reproduction quality
- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy

SE057939

AHT-100-1-94

Prepared by:
Dr. Mervin K. Strickler, Jr.

BEST COPY AVAILABLE

ABOUT THE AUTHOR

Dr. Mervin K. Strickler, Jr., a native of Pennsylvania, graduated from Clarion State University. In 1951 he received his doctorate from Stanford University with specialization in aviation higher education.

During his long and distinguished career he served as Director, USAF-Civil Air Patrol Aviation Education from 1951 to 1960, and as Director of the Federal Aviation Administration's Aviation Education Program from 1960 to 1979. From 1973 to 1979, he also worked with the Commonwealth of Independent States (then Soviet Union) as the FAA's representative for scientific and technical aviation education and training for all facets of civil aviation.

He continues today as an international consultant on aviation education matters to industry, government, and all levels of education.

Dr. Strickler's many publications and papers are included in libraries around the world. He is frequently called upon to speak at major aviation events and is well known nationally and internationally for his expertise in aviation education.

PREFACE

The Federal Aviation Administration's current interests, activities, projects and programs in aviation education represent and stem from a continuation and expansion of programs and similar initiatives of its predecessor organizations.

Present programs are a result of the most recent FAA Administrator's Task Force Report on Aviation Education completed in 1990. The Report identified over fifty aviation education initiatives as appropriate to support the agency's objectives.

As of mid-1993, FAA's Aviation Education Division programs use the top ten initiatives of the Task Force Report. This initial Phase I of the Report focuses on FAA's efforts to increase emphasis on the growing needs of a diverse society and work force.

FAA Aviation Education Division programs fall into four categories:

- information distribution
- educational relations
- youth and public education
- partnerships with government, industry and education

Our aviation education activities form a nucleus to help meet current Congressional mandates and help sustain the agency's aviation education mission in support of future requirements of the National Aviation System (NAS).

FAA is a part of a United States government-wide effort to assure appropriate federal responses to and support for improving the quality of education in the nation. This organization is known as the Federal Coordinating Council on Science, Engineering and Technology - Committee on Education and Human Resources (FCCSET-CEHR). This Aviation Magnet School Guide represents the kind of effort recommended by the FCCSET-CEHR.

FAA's long experience in aviation education proves that programs such as those described in this Guide, enhance learning and will ultimately contribute to a greater awareness of the role of air transportation as well as contribute significantly to improving education in the nation's schools.

It is realized that programs outlined in this publication will help attract and motivate a diverse population of young men and women to qualify for rewarding careers that will help in the design and operation of a safe and efficient future National Aviation System (NAS).

Phillip S. Woodruff, Division Manager
Aviation Education Division

"While the concept of the magnet school is not a new one, the application of that concept has been expanded and modified over the years as student and societal needs have changed. The first magnet school, Boston Latin, was actually founded in the 17th Century in 1635. Originally designated to meet the needs of a small intellectual elite, magnet schools now serve a twin focus: the improvement of educational quality while increasing racial integration. In addition, these schools often provide a setting for teacher-generated reform initiatives."

From Magnet Schools Recent Developments and Perspectives, Edited by Nolan Estes, Daniel U. Levine, Donald R. Waldrip.

"In a world that is highly and increasingly competitive, all of our children, including our best and our brightest are at risk. Meeting our national education goals requires that the performance of our highest achievers be boosted to match or exceed the performance levels of the best students anywhere in the world. The performance of our lowest achievers must also be substantially increased far beyond their current performance. What our best students can now achieve, our average students must be able to achieve by the turn of the century. We must work to ensure that a significant number of students from all races and ethnic groups, both male and female, and students from all income levels are among our best performers. I believe that our aerospace magnets are capable of responding to the needs and aspirations of all of these students."

Remarks by Alicia Coro, Director, School Improvement Programs, Elementary and Secondary Education, U.S. Department of Education, Washington, D.C. during the luncheon address at the Little Rock, Arkansas National Leadership Institute on Aerospace Magnet Schools, November 22, 1991.

TABLE OF CONTENTS

Preface

Section	Title	Page Numbers
I	Introduction	1-4
II	Defining Magnet Schools	1-15
III	Federal Aviation Administration Aviation Education Policy Statements	1-4
IV	Aerospace Magnet Schools Past - Present - Future	1-38
V	FAA and Aviation Education Yesterday - Today - Tomorrow	1-17
VI	Curriculum Models	1-240
	August Martin	1-62
	Aviation High School	63-74
	South Mountain	75-196
	Shawnee	197-239
VII	Selected Examples of Aviation/ Aerospace Education Programs	1-41
	Minuteman/Tech	1-3
	Center for High Technology/Roanoke	3-6
	Highland Springs	6-7
	Kent County	7-9
	Southside Center	9-12
	West County Tech	12-16
	BOCES II	16-20
	Miami - Dade County	20-22
	Washburn	22-26
	Sauk Rapids	27-31
	Delcastle	32-38
	Skyline	38-41
VIII	One Person Can Make A Difference	1-29
	Weber	1-10
	Wright Flight	10-16
	Opportunity Skyway	16-22
	Starbase	22-29
IX	Aviation Education In A Transportation Careers' Magnet School	1-18

X Supporting Feeder School Curriculum Preparation 1-18

XI Uses of Technology in Magnet School Programs 1-16

XII Preparing For Aviation - Aerospace - Transportation Careers 1-9

XIII Steps In Planning and Developing An Effective Magnet School Program 1-34

XIV Evaluating Magnet Projects, Activities and Programs 1-5

XV The First National Survey Of Secondary Aviation Magnet Schools - A Preliminary Report 1-26

XVI Suggestions For FAA Aviation Education Counselors 1-9

XVII Resources for Planning And Conducting Aviation - Space - Transportation Magnet Programs 1-26

Bibliography

SECTION I - INTRODUCTION

The Federal Aviation Administration (FAA) and its predecessor organizations, Civil Aeronautics Agency (CAA) and the Civil Aeronautics Administration (CAA) have pioneered the use of aviation education in working with schools and colleges of the nation to attain their objectives.

One of the first modern era magnet schools developed using a thematic approach featuring aviation, space and transportation is described in the FAA publication entitled: A Model Aerospace Curriculum - August Martin High School.

In many respects, this publication is designed to build on and replace the earlier developed August Martin High School curriculum guide. However, the lessons learned by community leaders, parents, educators, board of education members, representatives of labor unions, and local, state and federal officials who planned and carried out the August Martin program have relevance for anyone interested in magnet school planning today.

The FAA continues its long record of interest in and support for aviation education at all levels of education. In terms of aviation magnet schools the FAA, under the leadership of Mr. Phillip Woodruff, has planned and conducted the first two national level aviation magnet school conferences ever held in the United States. The first was held in cooperation with the Little Rock, Arkansas School District in November of 1991 and the second was held in Phoenix, Arizona in cooperation with the Phoenix Unified School District in November, 1992. The third such conference will be held in Louisville, Kentucky in cooperation with the Shawnee School District in November of 1993. A number of the ideas, examples of programs and aviation education suggestions included in this publication came from those who attended the 1991 and 1992 aviation magnet school national conferences.

This publication is designed to provide:

- a brief history of the role of aviation in motivating young people to learn.
- examples of aviation magnet activities, programs, projects and school curriculums.
- documentation of the benefits of aviation education for students.

- examples of what one person can do to facilitate aviation magnet education activities, projects, programs, curriculums.
- curricular and program models for use, adaptation or modification.
- identification of resources for planning a program of aviation education.
- information about and examples of curricula to prepare for the many career opportunities in aviation and transportation.
- guidelines and information for FAA Aviation Education Counselors.

According to the best available information, the longest continuously operating aviation thematic high school in the United States is the Aviation High School in New York City. It started operation in 1936. The program qualifies students for Federal Aviation Administration (FAA) certificated Airframe (A) and Powerplant (P) Maintenance Technician ratings in accordance with rules, policies, procedures and curriculum prescribed by Federal Aviation Administration Regulation (FAR-Part 147). Details of this historic program are described in this publication.

Many pre-flight aeronautics academic programs were taught in thousands of high schools during World War II in order to motivate more young people to join the military forces and become pilots or other air crew members. After the war most high schools dropped these programs.

Following World War II an innovative educator started a model high school aeronautics program that served to motivate many other teachers and schools. This Weber County High School program in Ogden, Utah was designed and taught by John V. Sorenson from 1949 to 1954.

More recently programs such as Wright Flight, Opportunity Skyway, Star Base I and the Experimental Aircraft Association (EAA) programs have emerged as examples of what can be done with mostly volunteer community resources. The actual construction and test flight of an aircraft is one example of such magnet projects.

Perhaps most important, there appears to be a growing body of literature on the effectiveness of magnet or thematic education programs. Illustrative examples of such data are included in this publication.

The FAA has materials for and interests in aviation education from kindergarten through elementary, middle, high school and two and four year college programs.

Questions answered in this publication include:

- What is Aerospace Education?
- What historic examples exist to illustrate aviation, space, transportation related scientific, technical and operational means to achieve educational ends?
- What evidence exists to justify aviation education, aerospace or related school and college educational programs as being educationally effective?
- Where were there or are there models of programs that work?
- What is the role of career education in aerospace education programs?
- What are some of the sources of information, assistance, guidance, possible funding, professional help and community support?
- Why should any school system plan to operate an aviation or aerospace magnet educational program?
- What evaluation techniques should be used in assessing an aerospace education program?

It should be noted that not all aviation or aerospace education magnet programs in the United States are listed in this publication. Examples described are illustrative of the variety of magnet projects that are possible.

The movement toward increasing numbers of magnet schools, programs, activities and projects is such that there are already hundreds of magnet programs in the United States. It appears there are more being planned on a regular basis. Not all of these, of course, use an aviation or aerospace theme. But the educational philosophy underlying all magnet programs, regardless of theme, is simple and direct: well-planned magnet programs provide excellence in education at all levels.

An indication of the growth of magnet schools may be seen in the preliminary results of the first survey of aviation or aerospace-oriented secondary schools as reported in Section XV. The list of these twenty-seven schools is provided.

As of May, 1993 the first phase of a national survey of all magnet schools, elementary and secondary, regardless of theme or central motif, was published by the organization, Magnet Schools of America. Dr. Ronald P. Simpson, President of Magnet Schools of America and Director of Student Admissions, Kansas City, Missouri Magnet School programs, planned and directed this survey. Dr. Simpson recently stated:

> "We have verified 1,701 schools throughout the country for their Magnet or Theme-Based presentation of curriculum and city-wide enrollment opportunities."

Magnet schools are growing in popularity and numbers.

Magnet programs demonstrate the literal meaning of the term magnet; that is, they attract. But a caution is in order because magnets can repel if they are not planned or positioned to attract.

SECTION II - DEFINING MAGNET SCHOOLS

Innovative educators have always used attractive methods to help students learn. As Dr. Nolan Estes has pointed out, 1635 marks the earliest identified magnet school - Boston Latin.

Using aviation as a central theme to facilitate learning only five years after the Wright Brothers pioneered the discovery of powered, controlled flight in 1903 a creative physics teacher, H. LaVonne Twining, in 1908, used aeronautical science and mathematics examples in his classes.

In the early decades of this century many school systems designed technical or vocational trade schools designed to prepare high school students for various technical trades. Today area vocational-technical schools provide similar career training opportunities. But relatively few, compared to the entire nation-wide public education system, make use of aviation or aerospace as a central theme. However, there are more and more school systems looking at the role of aviation, space, transportation as thematic approaches to education.

Magnet themes for elementary and secondary education are growing at a rapid rate. Many specialized topics provide core themes for a magnet approach to education. The U.S. Department of Education in a 1991 publication entitled: Magnet Schools: Promoting Equal Opportunity & Quality Education lists seventy-one "Magnet Curricular Themes and Learning Environments Supported Under the Magnet Schools Assistance Program."

Magnet school programs have evolved in recent years as a result of a number of initiatives. In many instances a creative teacher has used his or her specialized knowledge to introduce a core theme in traditional subjects to make the teaching more interesting and effective. This has been happening more and more in classes in elementary and secondary schools by teachers who have learned the value of aerospace in enhancing learning in all traditional subjects or disciplines.

Courts have mandated and approved magnet programs and schools to help remove racial segregation and ethnic isolation in some school districts.

The federal government has annually awarded several hundred million dollars to help school districts achieve voluntary desegregation plans and greater racial and ethnic balance in formerly segregated schools.

A detailed description of the role of magnet education programs as viewed by the U.S. Department of Education, Office of Civil Rights, as of May, 1991, is shown in the following material.

INTRODUCTION

Magnet schools are commanding increased interest and attention. From a few programs in major urban areas a decade ago, there are now more than a thousand magnet schools in large, medium and small school districts across the nation. While varying in scope, design, and outcome, magnet school programs share important objectives: promotion of educational excellence, equality of educational opportunity, and student and parental choice. Although no single method of organizing school systems will resolve all education problems or is suitable for all students, magnet schools have gained importance in efforts aimed at preventing, eliminating, or reducing racial isolation in our elementary and secondary schools.

MAGNET SCHOOL CONCEPT

While adhering to state standards for the core curriculum required for graduation, magnet schools offer specialized and innovative instructional approaches to attract students of different racial, ethnic, and socio-economic backgrounds. They include educational programs and services that are either the focus of an entire school (dedicated magnets) or are offered as part of a school's standard curriculum (mini-magnets). With respect to enrollment policy, a magnet school can be opened to all students in a school system (e.g., city-wide magnet) or restricted by attendance areas.

A variety of educational programs and methods are used in magnet schools, in conjunction with the core curriculum. Some magnets focus on a special learning environment, such as "open education," accelerated learning, or individualized continuous progress to meet special or unique needs of students. Most magnet schools emphasize core academic subjects but offer a distinctive theme-based curriculum that attracts students with specific interests. The overriding premise of magnet schools is that no single curriculum or instructional method is definitive for all students; therefore, parents and students may benefit from a range of choices in meeting their diverse education needs. Students in a magnet school can pursue individual interests, while completing core curriculum requirements for graduation.

USE OF MAGNET SCHOOLS

The establishment of magnet schools introduced a voluntary component to desegregation plans that had previously relied exclusively on compulsory strategies, such as busing students across attendance zones and pairing of schools. Federal courts began to approve desegregation plans that relied on, or incorporated, the use of magnet schools to achieve greater racial balance in formerly segregated school systems. State and local school administrators joined in the effort to attract students to magnet schools as an alternative to mandatory student assignment. In addition, some school systems, not under a legal obligation to desegregate, elected to establish magnet schools to counteract student racial isolation resulting from segregated housing patterns or other demographic factors. Interest in magnet schools also has paralleled the recent national reexamination of public education and subsequent local school reform activities. These efforts have concentrated on the following objectives: attaining educational excellence, improving the quality of instruction in core academic subjects, offering educational choice and diversity, renewing participation of parents in education decisions and restoring confidence in public schools.

DIVERSITY OF MAGNET SCHOOL PROGRAMS

Since magnet schools are part of the dynamic educational process, they are subject to constant change. Today, magnet schools feature diverse curricula, instructional approaches, and services that allow parents and students in communities with magnet programs to select a school that meets their education goals and special needs.

The examples of magnet school programs described below are broadly representative of those programs that have been or are now operating in many school districts throughout the United States. However, some of the examples such as the child-care program described under the Extended Day program, would not meet the requirements for funding under the federal assistance program for magnet schools described below.

MAGNET SCHOOL PROGRAMS - Elementary Schools

Basic Science and Technology

In this program, the focus is on science and technology education. While basic skills are emphasized, students are exposed to scientific themes in all their academic and enrichment areas. The facilities at the school include aquariums, a planetarium, greenhouse, satellite dish, and computer communications capabilities. After-school activities and summer programs reinforce students' interest in science. There is substantial participation by the higher education and business communities in the program.

Classical/Traditional Academy

This highly structured program is offered in an environment that stresses disciplined behavior, dress codes, and punctuality. The program concentrates on excellence in reading and writing, along with special emphasis on mathematics and science. There is rigorous teaching of spelling, listening, and studying skills. The classics in literature are emphasized at all grade levels.

Communication Arts

The program uses high technology equipment as a vehicle for improving reading, writing, speaking, and listening skills. Students use a television studio for long-range class projects involving script writing and telephone (sic) shows that are broadcast throughout the school. Multi-media centers are located in each classroom. Students receive instruction in using the computer in communication arts skills.

Environment Center

Ecology is taught as part of the science, health, safety, and social studies classes, in coordination with art, reading, and language arts. An environmental laboratory and greenhouse support the curriculum by providing activities for students to address problems of man and his environment.

Extended Day

An assortment of early morning and after-school enrichment activities are offered to children of working parents as an alternative to non-educational child care. In this program, the participating schools are located near high employment areas or along major traffic routes. The program offers computer labs and homework centers, activities in arts and crafts, recreation, music, dance, sewing, and cooking.

French Foreign Language Immersion

Students start this program in kindergarten and by third grade can acquire a fluency in French comparable to native speaking children of the same age. The program extends to grade 6. At the kindergarten and first grade levels, classes are taught entirely in French. English accounts for 25 percent of instruction time in grades 2 and 3. By grades 4 to 6, instruction is equally divided between French and English, with certain subject areas designated for each language.

High technology

The computer is an integral part of the entire instructional program. In terms of the core curriculum, computer assisted instruction is available in reading, math, and creative writing. This magnet program also provides individualized computer science instruction, including keyboard skills and programming.

International Studies

This program is intended to increase students' awareness of other parts of the world while concurrently developing their basic reading, writing, and math skills. Students are introduced to history, geography, economics, and the culture of other countries through a number of creative methods. These methods include learning folk tales and stories; studying holidays of various countries; using the metric system; and attending lectures by foreign visitors. An important objective of the program is to make students aware of the many international careers that will be opened in the next century.

Research and Study Skills Center

Students undertake individual research projects in the humanities, arts, and sciences in a program that emphasizes self-motivation and study discipline. In the process, students use word processors, conduct computer searches, and use the facilities of libraries, colleges, and museums. Students use various media including film, videotape, and photography when presenting the results of their research projects.

Science Magnet

The program is a "hands-on" approach to learning science that emphasizes reasoning, investigation, and the scientific method. Students produce science newsletters to enhance reading and writing skills. Career education activities are incorporated to make students aware of the range of job choices in the science field.

Intermediate Schools

Future Technologies School

The premise of this program is that computers, robots, laser beams, and satellite dishes will be in the home and work place when students become adults. Accordingly, the school introduces these technologies to prepare students for the future.

Medical

The program is for students who are considering medicine and related sciences. Students visit community health agencies and interrelate with a variety of health professionals. An expanded school day includes a club period allowing students to explore special interest areas in the medical profession.

Telecommunications and Computer Technology

In this magnet program, instruction in the regular core curriculum is enhanced through the resources of the cable television network (satellite transmissions) along with an expanded computer capability. Videocassette materials are also used extensively. In addition to instructional use of these technologies, students receive a three-year sequential course in computer technology.

High Schools

Aerodynamics Academy

Students with an interest and aptitude in aviation learn to fly in a general aviation/flight training program. Specialized courses supplement the core curriculum and include navigation, meteorology, theory of flight, aircraft design, hydraulic systems, and assembly of wood and metal structures.

Foreign Language Academy

This program offers foreign languages beyond the traditional choices. Students may enroll in Mandarin Chinese, Cantonese Chinese, Hebrew, Latin, German, Russian, or English as a second language. Two language laboratories, closed circuit and cable television, a language videotaping center, club activities, and field trips complement the learning of the language and the culture.

Health Care

This health/science magnet emphasizes broad-based preparation for future health-related careers. The school has close curricular links with a nearby medical college. Students have opportunities to work in hospitals and health centers as part of their studies. The first year is the most structured, with all students taking common core subjects. The skilled training later received makes employment possible in a health-related field for graduates not electing further education.

Petrochemical Careers Institute

Students work with petrochemical engineers and refinery technicians. A working model of a refinery is used in the classroom and is followed with hands-on work experience. Students are offered chemical laboratory technology, instrumentation/process operations, and mechanical technology. The program satisfies core curriculum requirements and provides college preparation as well as the kind of job experience that leads to direct employment.

School of Communications

This magnet offers hands-on experience in television, radio, and the print media. The state-required core curriculum is supplemented by intensive instruction in the technical side of media production, script writing, and live broadcasting.

University High School

This four-year program provides intense, comprehensive preparation for college. Students are expected to master the major academic competencies identified by the College Board as required for success in postsecondary education. Students select a major, and a related internship is required. The program emphasizes student participation in small tutorial groups and seminars, some conducted by visiting college professors. Students explore various aspects of college life and receive training in key study and communication skills in preparation for college level work and career decisions. There are opportunities for students to receive college credit for course work, including advanced placement courses.

Visual and Performing Arts

This program is designed for the artistically talented. Students participate and, eventually, major in one of the following areas: visual arts (painting, sculpture, graphic arts, architecture), dance (ballet, tap, modern, jazz), music (instrumental and vocal), theatre (performing, technical, management, criticism) or television/radio production (performance and technical). State-of-the-art technology and facilities support the program, which includes a complete television and recording studio, art gallery, and a computer/laboratory for graphic art and advertising. Students study with professional artists, dancers, musicians, directors, and radio/television personalities. The program provides a strong academic background in all core subjects and is designed to prepare students for further professional study and career options in the arts.

STATE MAGNET PROGRAMS

Besides individual school districts, several states have established magnet schools. For example, one state supports four regional magnet high schools for gifted students and students who are dissatisfied with programs offered in their local school systems. At least three states are now operating public residential high schools for students with high abilities in mathematics, science, and the arts.

In one such school, students can choose from structured courses, such as microbiology and astrophysics, or they can design their own one-on-one tutorials. Students also are encouraged to work with researchers at nearby universities and high technology firms. This school also has set up programs to improve statewide science-mathematics teaching, offering its faculty members as consultants to other public schools.

EFFECTIVENESS OF MAGNET SCHOOLS

There have been few comprehensive evaluations of the effectiveness of magnet schools. The majority of the research conducted has focused on general descriptions of individual magnet schools and comparisons of selected magnet programs. However, more empirical and refined research is being done to assess the operation and results of magnet schools.

The Department of Education has funded two studies to assess the effects of magnet programs on school desegregation. These studies are notable since they are among the few which have looked at magnet schools on a national basis.

The first study[1] found that magnet schools have a positive effect on district-wide desegregation under certain conditions. These include a strong policy commitment on the part of local school officials to the magnet school concept and to effective implementation of a desegregation program. School districts showing the most desegregation progress used magnets along with other desegregation techniques. The research findings also reported that magnet schools helped reduce community conflict concerning desegregation in over half of the school districts studied. In other districts, magnet schools worked towards anticipating and preventing conflict.

---

[1] Blank, R.A., Dentler, R.A., Baltzell, D.C., and Chabotar, K. Survey of Magnet Schools: Analyzing a Model for Quality Integrated Education. Chicago: James H. Lowry and Associates. September 1983.

The second study[2] also determined the significant contributions magnet programs can make in promoting school desegregation. The study compared comprehensive voluntary desegregation plans that relied primarily on magnet schools (most of the plans also contained some mandatory student reassignment) with mandatory desegregation plans (each of these plans also contained some magnet schools). The study found that the voluntary plans relying heavily on magnet schools desegregated school districts more effectively than mandatory plans over the long term. Furthermore, the reduction in student racial isolation tended to continue each year after the initial implementation of the magnet program.

Some smaller studies have focused on the relationship among students in magnet schools. The findings support the concept that magnet programs with high education quality tend to promote positive interracial interaction and understanding. Also, students in magnet schools tend to develop interracial friendships.

EDUCATION-RELATED ACCOMPLISHMENTS

Magnet programs offer the prospect of significant improvements and accomplishments related to the education process.

Quality Education - A principal conclusion of one national study is that magnet schools provide high quality education. One-third of the magnet schools in the study were rated highly on all of the following: instruction, curriculum, student-teacher interaction, student learning opportunities, and use of resources. Most of the other magnet schools in the sample were rated highly on some of these factors. These achievements with regard to the quality of the educational experience were unrelated to a magnet school's size, program theme, or organization (dedicated or mini-magnet). Nor did high quality education require selective admission of students. (The magnet schools were serving average as well as high-ability students.) This study identified three building-level factors to be consistently related to high-quality education: an innovative principal who exerts strong leadership in motivating staff and students and in developing curriculum; high coherence of the magnet theme, curriculum, teaching methods, and staff capabilities, resulting in a strong program identity and some flexibility with respect to application of the district's administrative rules and procedures.

---

[2] Rossell, C.H. and Clarke, R.C. The Carrot or the Stick in School Desegregation Policy? Report to the U.S. Department of Education, Washington, D.C. (March 1987).

Student Achievement - Improvement of reading and math test scores also has been linked with magnet schools. In one of the national studies, 80 percent of the magnet schools reported test scores above their district averages. More than 40 percent of these schools produced average test scores that were at least 10 points higher than their district averages. In 20 percent of the magnet schools tested, scores were more than 30 points higher than district averages. A number of studies not only show improvement in test scores but also reflect a reduction in the number of students scoring below grade level for minority as well as non-minority students. Several studies attribute these improvements to the use of the special curriculum and additional resources provided by magnet schools.

School Attendance and Discipline - Higher average daily attendance rates have been reported for magnet schools. Student dropout, suspension, and school transfer rates also have been reported lower than district averages in comparable non-magnet schools.

One school district reported a 36 percent reduction in school vandalism since the introduction of its magnet program. Some data are indicating a reduction in violence in magnet schools, including magnet schools specifically designed to attract delinquent or disruptive students. The research also relates these results to the voluntary enrollment and unique characteristics of magnet schools.

Student Satisfaction - One study reported that when students attend magnet schools for at least a three-year period, there is an increase in their self-esteem and in overall school satisfaction relative to students who attend non-magnet schools. Studies also are reporting significant increases in the number of students in magnet schools who participate in extracurricular activities, as compared with students who attend non-magnet schools.

Parent Participation - In the few studies where this has been considered, the participation of parents of magnet school students was higher than for parents of other students.

Teacher Expectations and Performance - The most recent research reports that teacher expectations of students in magnet schools are not affected by the student's race. This is in contrast with previous attitudinal studies that indicated teachers expected less of minority students. There is some evidence that magnet schools can be a means for renewing teacher interests and motivation through establishment of a common academic goal and interdisciplinary curriculum planning. Also there is evidence of greater job satisfaction on the part of magnet school teachers.

Educational Diversity and Choice - Magnet school programs are successful in offering educational diversity and choice. Research has related these factors to achievement of educational excellence. Also, many case studies of magnet schools show that providing diversity and choice accounts, in large part, for the attraction of magnet schools for students and parents.

Perceptions of Public Schools - Many magnet schools are having a positive effect in reducing enrollment decline in their school districts. In some cases, magnet schools have not only stemmed the flow of students to private schools but also have succeeded in attracting large numbers of students back to the public school system. In one reported school system with a long history of racial turmoil, 4,000 students returned to the public schools during a three-year period, which corresponded to the district's institution of a magnet school program. The existence of magnet schools also may challenge other schools to improve the quality of their instructional programs, which appears to be related to competition among schools for students.

Magnet schools have slightly higher average costs per pupil than non-magnet schools according to one reported research study. Magnet schools with specific single themes (e.g., arts or science) had lower costs than combination magnets with two or more themes. Costs declined for magnet schools at all levels after the start-up years. The items on which magnet schools continued to spend more money than non-magnet schools were teacher salaries (teachers in magnet schools tend to have more years of experience) and student transportation. Also, this study concluded that school districts that made the commitment to cover the extra costs benefitted by attaining increased quality education and student desegregation.

COMMUNITY-RELATED ACCOMPLISHMENTS

Community Confidence - Effective magnet schools can help increase community confidence in public education. In many instances where the magnet program has carried out its objectives, public support for the school district has increased substantially.

Citizen Participation - Some case studies of magnet schools indicate that their establishment has resulted in larger citizen participation in the education process. This support varies but often includes participation in program design or curriculum, development and volunteer work at the school sites (e.g., teacher aides).

Partnership Programs - Through magnet school programs, the private sector is encouraged to participate in public education in new ways. Partnerships have been formed between magnet schools and business and industry, labor unions, colleges and universities, and creative arts groups. Some Adopt-A-School programs pair individual schools with these organizations. In turn, these organizations assist in the development of curricula and the provision of resources (including the loan of facilities, equipment, and personnel) for learning. In one school district, there are more than 40 such partnerships. In another district, businesses are paired with specific magnet schools to provide a hands-on approach to academic programs, while labor organizations have developed vocational, technical, and trade programs.

FINANCIAL SUPPORT FOR MAGNET SCHOOLS

The Magnet Schools Assistance Program (MSAP) provides federal financial assistance to plan, establish, and operate magnet schools that offer a special curriculum capable of attracting substantial numbers of students of different racial backgrounds. A local education agency (LEA) is eligible to receive assistance under MSAP if it is implementing a desegregation plan required under a court order or state-agency order or implementing a desegregation plan approved by or required by the Office for Civil Rights (OCR). The MSAP program is administered by the Department of Education's Office of Elementary and Secondary Education.

Grants to school districts are authorized to eliminate, reduce, or prevent minority group isolation in elementary and secondary schools and to strengthen academic and vocational education skills in students attending magnet schools. Funds may be used for planning, promotion activities, teacher salaries and the acquisition of books, materials, and equipment (including computers). Funds may not be used for activities that do not augment academic improvement. In addition to programmatic selection criteria, under the law, special consideration is given to the recentness of the implementation of an applicant's desegregation plan, proportion of minority children involved in the plan, cost or difficulty of carrying out the plan and extent to which the purposes of MSAP - including the prevention, elimination, or reduction of racial isolation - are attainable. Under the 1988 reauthorizing legislation, special consideration must also be given to projects that involve collaboration with colleges and universities, community organizations, the appropriate state education agency, or other private organizations.

Grants under MSAP are awarded on a competitive basis. School districts receive one-year awards and may apply for second-year continuation grants. These are approved if the school district is making satisfactory progress toward achieving the purposes of the program. An eligible district may receive no more than $4 million in any one fiscal year.

The MSAP defines "special curriculum" as a course of study offered to students in the magnet school program that embraces a subject matter or teaching methodology that is not generally offered to students of the same age or grade level in the same LEA. The special curricular themes and learning environments that MSAP grants have made possible for children attending magnet schools are listed below.

1. Academics and Athletics Academy
2. Academic Acceleration
3. Academy of Academics and Arts
4. Agribusiness
5. Alternative Education
6. Basic Option
7. Business and Commerce
8. Business and Management
9. Business and Technical Careers
10. Career Awareness
11. Center for Humanities
12. Center for Performing Arts
13. Classical Greek
14. College Preparation
15. Communications Management
16. Communications Techniques
17. Communications (Print and Broadcast)
18. Computer Science
19. Computer Technology
20. Creative Arts
21. Creative Dramatics
22. Cultural Arts
23. Early Childhood Education
24. Ecology and Energy
25. Education and Social Science
26. Engineering
27. Environmental Education/Outdoor Education
28. Environmental Science
29. Expressive and Receptive Arts
30. Fine Arts
31. Foreign Language Immersion

32. Fundamental Magnet School
33. Future Studies
34. Gifted and Talented
35. Global Education
36. Graphic Arts
37. Health Professions Center
38. High Intensity Learning
39. High Technology
40. Honors Arts
41. Horticulture
42. IGE (Individually Guided Education)
43. Intellectually Gifted
44. International Studies
45. Latin Grammar
46. Law and Government
47. Law-related Education
48. Liberal Arts
49. Literary Arts
50. Machine Trades and Robotics
51. Marine Science
52. Math/Science
53. Medical Science and Mathematics
54. Military Academy
55. Montessori Option
56. Multicultural School
57. Music and Multi-Arts
58. National and Biological Sciences
59. Navy Junior ROTC
50. Open Classroom Concept
61. Performing and Visual Arts
62. Pre-engineering
63. Professional Careers Exploration
64. Science and Technology
65. Structure of the Intellect
66. Telecommunications
67. Total School Enrichment
68. Traditional School
69. TV and Radio Production
70. Vocational Education
71. Writing

OFFICE FOR CIVIL RIGHTS

The Department of Education's Office for Civil Rights (OCR) reviews applications for funds under MSAP to determine whether an applicant district has established eligibility based on its desegregation plan and whether the district is likely to meet its civil rights assurances.

Desegregation Plan Eligibility - An applicant must have an approved desegregation plan containing a magnet school component. This plan may also be approved or required by OCR. In approving a magnet school component, OCR must determine that this magnet school component has been or will be effective in reducing, preventing, or eliminating minority group isolation.

Civil Rights Assurances - An applicant must provide assurances that it will not engage in discrimination based on race, color, national origin, religion, handicap, or sex in the hiring, promotion, or assignment of employees, in the mandatory assignment of students to schools or courses of instruction, and in extracurricular student activities.

OCR must determine whether these assurances will be met. This determination is based on a review of the applicant's record of compliance with the appropriate federal nondiscrimination laws. Information from other federal, state, or local civil rights agencies is considered along with information gathered by OCR.

Information about MSAP can be obtained by writing to the U.S. Department of Education, Office of Elementary and Secondary Education, 400 Maryland Avenue, S.W., Washington, D.C. 20202.

SECTION III - FEDERAL AVIATION ADMINISTRATION AVIATION EDUCATION POLICY STATEMENTS

BY JAMES B. BUSEY, ADMINISTRATOR

The Federal Aviation Administration (FAA) has a rich history of dedication and commitment to aviation education. The Congress has recognized this historic leadership role by requiring a civil aviation information distribution program within each FAA region to support the agency's aviation education program.

Aviation education is an integral element of the agency's mission and is essential to carrying out its responsibilities of promoting aviation and flight safety.

Therefore, it will be the policy of the FAA to support aviation education and to expand its scope under the theme of "aviation awareness" with new, broader program initiatives. This expanded effort will focus on the general public, through partnerships with the private sector, states, and communities; pilots, mechanics, and other airmen; colleges and universities; as well as public and private schools at all levels.

Our goal is to provide increased awareness of civil aviation to promote intelligent, informed decisions about aviation by citizens and community leaders. We aim to promote an aviation-aware society, which understands and respects the economic importance of aviation at the national and community levels.

A key focus during my administration is to stimulate interest in aviation careers among America's young people, in order to provide a steady flow of skilled professionals, especially women and minorities. This will ensure America's continuing preeminence in world aviation.

EXCERPTS OF REMARKS BY FANNY RIVERA, DEPUTY ADMINISTRATOR, WESTERN REGION, FAA AT SECOND ANNUAL AVIATION MAGNET SCHOOL CONFERENCE PHOENIX, ARIZONA, NOVEMBER 20, 1992

FAA COMMITMENT TO AVIATION EDUCATION

The FAA has a rich history of dedication and commitment to aviation education. Our commitment is based on the knowledge that our future depends on America's youth.

If the United States is to maintain its preeminence as the world leader in aviation, we must strive to provide the best possible educational opportunities for our children.

DIVERSITY

We must recognize that our youth is diverse and take advantage of their knowledge, skills and experiences.

We must draw upon people from all cultures and backgrounds to build and maintain our nation's airplanes, design and develop our electronic aids to navigation or perform the myriad of other jobs necessary to operate an ever more technical and complex airspace system.

It is imperative that we as an agency recognize this and make every effort to ensure the availability of a well qualified, highly trained and motivated work force, ready to meet the demands of tomorrow's aviation industry.

ACTION

Our commitment to our diverse youth does not solely equate to words. For it to truly have meaning, it must equate to actions.

FAA sponsorship of this conference demonstrates our resolve to promote aviation in the classroom. It reinforces our commitment to foster the development of quality high school aviation programs.

The interdisciplinary, thematic approach, one that uses aviation as the key which binds together - mathematics, science, language arts, social studies, history and art - can help forge new ways to motivate students to gain the most from their education.

MISSIONS

The FAA has a simple but vital mission: to ensure the safe and efficient use of our nation's airspace.

The same is true of our aviation education mission: to promote the understanding of aviation and the vital role it plays in our nation's social and economic development.

These missions together will pave the way to helping our nation's youth chart a clear path toward career success.

I invite educators to become partners with us, to take advantage of the resources we have to offer, and together we can build a work force of the future and ensure that our nation will remain on the cutting edge of aviation technology.

FAA AVIATION EDUCATION PROGRAM POLICY STATEMENT FROM AVIATION EDUCATION RESOURCE CENTERS PUBLICATION BY PHILLIP S. WOODRUFF, DIRECTOR OF AVIATION EDUCATION

The Federal Aviation Administration (FAA) has a rich history of dedication and commitment to aviation education. The Congress has recognized this historic leadership role by requiring a civil aviation information distribution program within each FAA region to support the agency's aviation education program.

Aviation education is an integral element of the agency's mission and is essential to carrying out its responsibilities of promoting aviation and flight safety.

The agency is dedicated to the development and implementation of aviation education programs which provide general education for all citizens and information on aviation careers for America's young people with a special emphasis on women and minority youth.

WHY FAA IS INTERESTED IN AVIATION MAGNET SCHOOLS

The FAA is engaged in a comprehensive program to modernize the Nation's air transportation system to meet the challenge of aviation growth in the coming decades. The modernization program takes advantage of current technological advances to increase the capacity of the Nation's air transportation system while reducing relative costs to the Nation's taxpayers. The FAA recognizes the increasing complexity of technical and managerial skills that will be needed to accommodate the technological advances in systems being planned and implemented throughout the aviation industry. FAA further recognizes that our educational system will play a critical role in preparing persons for careers in this advanced technological environment. For these reasons, FAA supports the development of aviation magnet secondary schools.*

*From The Federal Register, Volume 57, No. 150, Tuesday, August 4, 1992

SECTION IV - AEROSPACE MAGNET SCHOOLS PAST - PRESENT - FUTURE

The following material is adapted from the Background Paper prepared for the Keynote Address at the 1st Annual National Leadership Institute on Aerospace Magnet Schools sponsored by the Federal Aviation Administration and the Little Rock, Arkansas District School System, November, 1991 by Dr. Mervin K. Strickler, Jr.

WHAT IS AEROSPACE EDUCATION?

Before defining aerospace education, one needs to assure what is meant by education. The definition I prefer to use in defining education is simple to state but challenging to attain. Simply put, for purposes of this paper, the definition of education is that it is synonymous with behavior change. In short, one defines education by inference. If a student enters a purported educational program - at any level of development - and leaves the program, course, project or experience and thinks, believes and behaves the same afterward as before, then no education has taken place. On a positive note, society defines the acceptable behaviors one expects from schooling, education. In our pluralistic society with our nation's historic and cherished tradition of local autonomy in education not all communities will agree with all of the manifest behaviors that are desired. However, we do generally have a national consensus as to the behaviors or performance one expects from a citizen who is educated - or who is supposed to be.

Before discussing education further at this point one needs to define aerospace.

Aerospace may be defined both as an activity and as an environment. As a field of activity, aerospace includes astronautics and aeronautics. As an environment, aerospace includes that total expanse extending upward and outward from the earth's surface and through the atmosphere and to space beyond. In understanding the scope of aerospace, especially in terms of how it relates to education, one needs to realize there are ten major categories within aerospace. These categories are:

I. The Environment
II. The Basic Sciences in Aerospace
III. Man in Flight

IV. People & Events in Aerospace Development
V. Aerospace Vehicles
VI. Aviation & Space Operations
VII. The Art and Techniques of Flight
VIII. Communications & Control
IX. Manufacturing & Facilities
X. Aerospace & Society

A more detailed breakdown of each of these categories is shown below. Study of these categories readily shows the relationships between all elements that go to make up aerospace and the many disciplines ranging from A to Z, Art to Zoology, Alpha to Omega. Anyone planning a total curriculum or just small elements of a subject should first consult this detailed, inclusive outline.

I. **THE ENVIRONMENT** - The earth must be considered the basic reference point for all flight with its mantle of atmosphere thinning into the vacuum of endless space as the realm of aerospace flight.

  A. **Earth** - Our planet's basic characteristics form our standards of time, distance and magnitude; and determine the perimeters of our understanding of the universe.

    1. Basic characteristics
    2. Reference system
    3. Earth-Moon relationship

  B. **Aerospace** - The aerospace realm is divided and subdivided into many regions depending upon a particular disciplinary viewpoint. Flight through the atmosphere and in space are quite distinct with a merging of the two in a zone that has some of the environmental characteristics of both.

    1. Atmosphere (0 - 70,000 ft.)

      a. Structure
      b. Composition
      c. Phenomena

    2. Transition zone (70,000 ft. - 50 miles)

3. Space (beyond 50 miles)
    a. Structure
        (1) Weather
        (2) Jet Streams
        (3) Earth
        (4) Solar System
        (5) Stars
        (6) Galaxies
        (7) Universe
        (8) Regions of Space
    b. Near Earth-Space Phenomena - The venture into space resulted in the discerning of many phenomena. These phenomena are sometimes called weather of space and must be considered in planning spaceflight, much the same as in atmospheric flight.
        (1) Meteoroids
        (2) Radiation
        (3) "Space weather"

APPLICABLE VOCABULARY: air air masses asteroids astrogeology astronomy atmosphere aurora aviation weather barometric pressure celestial sphere clouds comets constellations convection currents cosmic rays density altitude earth eclipse escape velocity evaporation & condensation fog galaxies gravity greenhouse effect humidity Jupiter latitude and longitude lightning Mercury meteors moon Neptune ozone planets Pluto precipitation quasar radiation solar system space weather stars sun turbulence ultraviolet universe Van Allen belts Venus weather wind

II. **THE BASIC SCIENCES IN AEROSPACE** - The basic sciences underlie all the activities of aerospace. They are often applied in new and unconventional ways and have forced the emergence of obscure branches of a basic science into surprising prominence, even to the point of creating new career fields. One interesting example is cryogenics.

A. Astronomy
B. Biology
C. Chemistry
D. Earth Sciences
E. Electricity and Electronics
F. Flight Sciences
    1. Aerodynamics
    2. Astrodynamics

G. **Meteorology** - Note: Meteorology is separated from Earth sciences because of its significance to aeronautical operations.

H. **Nuclear Physics**

I. **Physics**

1. Electromagnetism
2. Heat
3. Mechanics

APPLICABLE VOCABULARY: acoustics airfoil astrophysics atoms Bernoulli's principle binary numbers bird flight Boyle's law celestial mechanics chemical energy cryogenics crystallography Doppler effect dynamic soaring elements energy extraterrestrial life fluid mechanics gases heat energy infrared radiation lasers light matter measurement of power metals and metallurgy Newton's laws noise nuclear energy orbits and trajectories parabola photosynthesis plasma Quantum theory radio astronomy relativity theory semiconductors shock waves solar cells solid-state physics space biology spaceflight principles temperature scales x-rays

III. **MAN IN FLIGHT** (Aerospace Medicine) - Man has a very limited ability to adapt to the changing conditions as he flies higher and faster into an increasingly hostile environment which quickly requires a self-contained artificially created atmosphere to sustain life.

A. **Medical Aspects**

1. Physiological factors
2. Psychological factors
3. Circadian rhythms

B. **Pilot and Astronaut Qualifications**

C. **Preparatory Training**

1. Acclimation
2. Simulators
3. Survival training

D. **Food and Nutrition**

E. **Environmental Protection and Control**

1. Clothing and equipment
2. Escape systems
3. Emergency systems
4. Vehicle design
5. Human engineering

APPLICABLE VOCABULARY: acceleration aerospace medicine animals in space Apollo astronauts aviation medicine bends biosatellites circadian rhythm closed ecological system cosmonauts crash investigation cybernetics decompression drug effects environmental control systems flight (as passenger) flight physical flight simulators food and nutrition Gemini high-altitude flight training human engineering human factors hydroponics hypoxia interplanetary travel life-support systems man in flight manned spaceflight Mercury program parachutes pilots and pilot certificates pressurization psychological factors of flight sensory deprivation space biology spaceflight training space medicine spacesuits technological projections temperature control walk in space weightlessness

IV. **PEOPLE AND EVENTS IN THE DEVELOPMENT OF AEROSPACE** - Modern aerospace has its roots in mythology and legend; however, its role as a meaningful part of our society has only developed during the past few decades.

A. **Significant Contributors**
B. **Pioneering Organizations**
C. **Records and Achievements**
D. **Mythology and Legend**
E. **Major Eras**

    1. Pre-powered flight
    2. Pre-World War I
    3. World War I
    4. Between Wars
    5. World War II
    6. Post World War II
    7. Future

APPLICABLE VOCABULARY: ace airmail altitude records balloons barnstormers Battle of Britain Berlin Airlift biographies commercial airlines Da Vinci, Leonardo Desert Storm distance records endurance records First World War aircraft flying circus International Geophysical Year International Year of the Quiet Sun Iran-Iraq War Israeli-Arab Conflict - 1967 kamikaze Korean War Luftwaffe man-powered flight medals and decorations military aviation mythology National Advisory Council for Aeronautics Peenemuende Rheims Air Meet rockets and rocketry science fiction speed records trophies and awards Vietnam War women in aerospace World War I World War II

V. **AEROSPACE VEHICLES** - The hardware of aerospace is the great variety of aircraft, launch vehicles, spacecraft, weapons and related onboard equipment designed to perform specific tasks.

A. **Aircraft**

    1. Lighter than air

        a. Airships
        b. Balloons

BEST COPY AVAILABLE

2. Heavier than air

    a. General aviation
    b. Air transports
    c. Military (High Performance)
    d. V/STOL

        (1) Rotary Wing
        (2) Other

    e. Gliders

B. **Ground-Effect Machines**
C. **Instruments and Controls**
D. **Aerospacecraft** - Aerospacecraft can be operated and controlled in both atmospheric and space flight. Examples are the X-15, lifting bodies, space shuttle.
E. **Flight Simulators**
F. **Propulsion Systems**

1. Reaction engines

    a. Gas turbine
    b. Rockets
    c. Electric

2. Reciprocating engines (piston-propeller)
3. Other systems
4. Fuels

G. **Spacecraft**

1. Manned

    a. Russian programs

        (1) Vostok
        (2) Voskhod
        (3) Soyuz
        (4) MIR

    b. American programs

        (1) Mercury capsules
        (2) Gemini capsule
        (3) Apollo vehicles
        (4) Skylab
        (5) Space Shuttle

    c. Space stations

PAST - PRESENT - FUTURE

2. Unmanned
    a. Sounding Rockets
    b. Satellites
    c. Space probes
    d. Lunar exploration
    e. Planetary exploration

H. **Launch Vehicles**
    1. Liquid Fuel
    2. Solid Fuel
    3. Air Breathing

I. **Aerospace Weaponry**
    1. Missiles
    2. Bombs, guns and cannons

APPLICABLE VOCABULARY: aircraft propulsion systems airplane airships airspeed indicator Apollo applications technology satellites area rule Atlas missile autogiros balloons bomber aircraft bombs carburetion cargo aircraft center of gravity commercial air transports communications satellites dirigibles engines fighter aircraft flight simulators fuels gas turbine engines Gemini general aviation aircraft generators and alternators gliders ground-effect machines heat shields helicopters high-lift devices homebuilt aircraft hydraulic systems hypersonic flight instrument panel interiors of aircraft jet aircraft jumbo jets kites Kosmos satellites launch vehicles lubricants magnetic levitation (MAGLEV) manned orbiting laboratory Mercury program missiles model aircraft nuclear propulsion pitot-static system propellants ranger reciprocating engines reconnaissance satellites re-entry vehicles robots rockets and rocketry rotating combustion engines sailplanes satellites Saturn rockets Second World War aircraft Skylab solar cells sounding rockets spacecraft design space propulsion systems Space Shuttle space stations supersonic flight supersonic transports surveyor temperature control V/STOL aircraft weaponry weather satellites wings x-series aircraft

VI. **AVIATION AND SPACE OPERATIONS** - The operational activities of the three major divisions of aerospace are distinctive yet have a considerable degree of interrelationship.

A. **Civil Aviation** - Civil aviation relies upon aircraft as a means of rapid transportation with some specialized industrial uses such as crop dusting, fire fighting, traffic control where the three dimensional utility of the aircraft becomes important.

1. Commercial Air Transportation
    a. Worldwide systems
    b. Aircraft programs

2. General Aviation
    a. Sport
    b. Private
    c. Business
    d. Agricultural
    e. Industrial

B. **Military** - Aerospace vehicles have become the backbone of modern warfare both offensively and defensively. Aerospace power is the modern counterpart of 18th century sea power.

1. Branches and Commands
2. Wars in the air
3. Research and development
4. Logistics
5. Space applications
6. Missile Warfare
7. Search & Rescue

C. **Space Exploration** - The international space programs have already begun to branch out from the mainstream effort of exploration and the gathering of scientific data. Major programs are underway to make use of space vehicles and space science to improve our way of working and living.

1. Manned Missions
    a. Orbital
    b. Lunar landing
    c. Interplanetary
2. Unmanned Scientific Missions
    a. Physics & astronomy
    b. Lunar and planetary
    c. Bio-science
    d. Solar
    e. Geodetic
3. Satellite Applications
    a. Meteorological
    b. Earth resources
    c. Navigation
    d. Communications

4. Advanced Research
5. Power Generation
    a. Vehicles
    b. Systems
    c. Control

APPLICABLE VOCABULARY: aerial photography agricultural aviation air defense systems Air Forces of the world air raid air traffic control air taxis Apollo applications technology satellites Army aviation bush flying business aviation charter flying Coast Guard aviation commercial airlines communications satellites cloud seeding crash investigation crop dusting demonstration teams DEW line Discoverer environmental research satellites European aerospace activities Explorer satellites fighter aircraft flight (as passenger) flight test programs flying doctor services forest fire control Gemini general aviation geodesic satellites gliding International Flying Farmers Interplanetary travel launching lunar exploration manned spaceflight Marine Corps aviation Mariner probes Mercury program military aviation military space program mountain, desert and jungle flying naval aviation navigation satellites NORAD oceanographic research orbiting observatories photography photogrammetry polar flight police and fire services preventive maintenance reconnaissance re-entry vehicles refueling rendezvous and docking rockets and rocketry rescue and recovery service search and rescue sport flying Strategic Air Command technological projections telescopes U.S. Air Force U.S.S.R. aerospace activities utility aviation

VII. **THE ART AND TECHNIQUES OF FLIGHT** - Aeronautical skills have grown from the trial and error techniques of pioneering aviators to precise control of today's sophisticated aircraft. The term "interface" has been coined to describe the interrelationship of a man, with his knowledge and capability, and the functioning of his vehicles. The two are a functioning unit. Astronautics and aeronautics form a continuum. Conceptually, navigation, communications, environmental control, instrumentation, etc., are similar in both; but the degree of advancement and sophistication in astronautics is considerable.

A. **Aviation Weather** - Note: Aviation weather should be distinguished from meteorology as the reporting, interpretation and evaluation of weather relating to the use of aircraft.

B. **Aeronautical Skills**

1. Pilot training
2. Flight technique and management
3. Navigation
4. Maneuvers
5. Flight planning

C. **Astronautical Skills**

1. Astronaut training
2. Mission simulation
3. Mission planning
4. Mission activities

D. **Aids to Flight**

1. Maps and charts
2. Pilot equipment
3. Manuals
4. Reference Materials

E. **Related Activities**

1. Test piloting
2. Aerobatics
3. Exhibition and demonstration flying
4. Skydiving

APPLICABLE VOCABULARY: aviation weather bank bush flying celestial navigation charts compasses course plotting dead reckoning flight computers flight instruction flight management flight plan flying safety high-altitude flight training instrument flight techniques lunar charts magnetic course maneuvers maps and mapping mountain, desert and jungle flying navigation techniques pilotage pilot and crew wings pilots and pilot certificates pilot training power management preflight training spaceflight principles test pilots and test flying weathermaps and charts weight and balance

VIII. **COMMUNICATIONS AND CONTROL** - The expanding use of aircraft-coupled with their increasing speeds and flight capability require an air traffic control system which can provide precise inflight and terminal area guidance. This task would be hopeless without the aid of electronics. The enormous capacity of electronic computers is becoming increasingly vital to the process of keeping man ahead of his inflight machines.

Spaceflight presents far more sophisticated problems in communications and control related to the precision maneuvers required and the sheer magnitude of speeds and distances encountered. Without advanced electronics interfaced with computers, today's spaceflight programs would be virtually impossible.

A. Aviation

   1. Avionics
   2. Air Traffic Control
   3. National Airspace System

B. Radar
C. Radio Communications Data Acquisitions
D. Space

   1. Astrionics
   2. Tracking system
   3. Guidance and command

E. Cybernetics

   1. Science of control and communication processes in man and machines

APPLICABLE VOCABULARY: air traffic control astrionics attitude control automatic landing avionics bearing communications satellites computers cybernetics data acquisition and processing Doppler navigation electronics electromagnetism flight plan ground control approach guidance and control systems gyroscope inertial guidance information systems instrument flight rules lasers microwave Morse code National Airspace System navigation systems navigation satellites phonetic alphabet radar radio radio communications spaceflight principles telemetry television tracking systems and networks visual flight rules

IX. MANUFACTURING AND FACILITIES - A vast industrial complex is necessary to support the research, development, and manufacture of aerospace craft. The functional use of these vehicles is dependent upon complex worldwide supporting facilities.

A. Civil Aviation

   1. Airports
   2. Terminals
   3. Surface transportation

B. Military Aerospace Facilities

   1. Air bases
   2. Aircraft carriers
   3. Air defense command networks
   4. Launch sites

C. **Space Flight Facilities**

  1. Launch complexes
  2. Control and support centers
  3. Observatories

D. **Industry**

  1. Manufacturing
  2. Research & development
  3. Materials

E. **Research, Development, and Testing**

  1. Wind tunnels
  2. Test sites
  3. Research centers

APPLICABLE VOCABULARY: aeronautical center (FAA) aerospace industry aircraft carriers airports alloys blockhouse certification procedures computers DEW line environmental simulators fabrics fixed base operation flight service stations ground antennas ground service and maintenance hangars heliports high-speed surface transportation interiors of aircraft Kennedy Space Center launch facilities lunar bases manufacturing materials metals and metallurgy observatories planetariums production techniques program management refueling runways testing wind tunnels

X. **AEROSPACE AND SOCIETY** - The technological achievements of aerospace must be viewed in the context of involvement and effect upon the world society to be understood in proper prospective.

A. **Implications**

  1. Social
  2. Economic
  3. Political
  4. Legal
  5. Educational
  6. Career opportunities

B. **Societies, Organizations and Associations**
C. **Aerospace Industry**
D. **Government Involvement**

  1. United States

    a. Government promotion

PAST - PRESENT - FUTURE

        (1) Military
        (2) NASA
        (3) Airports
        (4) National Airspace System

    b. Government regulation

        (1) Aviation and space law
        (2) Federal aviation regulations
        (3) Economic
        (4) State
        (5) Local

2. United Nations and International Agreements
3. Foreign Nations

    a. Civilian
    b. Military
    c. Space programs

APPLICABLE VOCABULARY: Air Commerce Act   Australia's aviation   careers   National Transportation Safety Board   commemorative stamps and medals   crash investigation   economic implications   educational implications   Eurospace   FAA   FAI   FAR   Five Freedoms   government contracts   government in aerospace information systems   insignia   insurance   international agreements   International Agricultural Aviation Centre   International Flying Farmers   legal implications   military implications   NASA   objects of art   occupations   patents   pilots and pilot certificates   political implications   program management   registration of aircraft   safety statistics   social implications   space law   stewards and stewardessses   systems engineering   technological projections   terminology of aerospace   UFO's

Following is a listing of aerospace topics in the context of how facets of aerospace relate to curriculum.

HOW THEY ARE BUILT IS INDUSTRIAL ARTS.

WHO CONTROLS THEM IS GOVERNMENT.

WHAT THEY COST IS ECONOMICS.

WHERE THEY LAND IS SOCIAL STUDIES.

WHO MADE THEM FLY IS HISTORY.

WHERE THEY FLY IS GEOGRAPHY.

WHAT THEY COST IS ECONOMICS.

SELECTED AEROSPACE TOPICS IN CURRICULUM CONTEXT

AGRICULTURE

- Aerial photography
- Agricultural aviation
- Australia's aviation
- Crop dusting
- Cloud seeding
- Economic implications
- Food and nutrition
- Infrared radiation
- International Agricultural Aviation Center
- International Flying Farmers
- Photosynthesis
- Weather
- Weather satellites

ART

- Balloons
- Commemorative stamps and medals
- Da Vinci, Leonardo
- History of aviation
- Insignia
- Interiors of aircraft
- Kites
- Medals and decorations
- Model aircraft
- Mythology
- Objects of art
- Photography
- Pilot and crew wings
- Science fiction
- Trophies and awards

ASTRONOMY

- Asteroids
- Astronautics
- Astronomy
- Astrophysics
- Celestial mechanics
- Celestial sphere
- Comets
- Constellations
- Cosmic rays
- Eclipse
- Galaxies
- International Years of the Quiet Sun
- Interplanetary travel
- Kepler's laws
- Light
- Mariner probes
- Meteors
- Moon
- Observatories
- Orbiting observatories
- Orbits and trajectories
- Planetariums
- Planets
- Quantum theory
- Quasar
- Radio astronomy
- Relativity theory
- Solar system
- Stars
- Sun
- Telescopes
- Ultraviolet
- Universe
- X-rays

BIOLOGY

- Animals in space
- Aviation medicine
- Biosatellites
- Bird flight
- Circadian rhythm
- Closed ecological system
- Extraterrestrial life
- Hydroponics
- Kosmos satellites
- Photosynthesis
- Space biology

BUSINESS LAW

- Airports
- Certification procedures
- Crash investigation
- Government contracts
- Insurance
- Legal implications
- Patents
- Police and fire services
- Registration of aircraft

CAREER GUIDANCE

- Air traffic control
- Army aviation
- Astronauts
- Careers
- Charter flying
- Cryogenics
- Crystallography
- Cybernetics
- Flight instruction
- General aviation
- Government in aerospace
- Ground service and maintenance
- Manufacturing
- Occupations
- Pilots and pilot certificates
- Pilot training
- Spacecraft design

PAST - PRESENT - FUTURE

Stewards and stewardesses
Test pilots
Women in aerospace

CHEMISTRY

Air
Alloys
Atoms
Atmosphere
Chemical energy
Closed ecological system
Cryogenics
Elements
Fuels
Gases
Lubricants
Propellants
Specific gravity

EARTH SCIENCE

Air masses
Applications technology
  satellites
Astrogeology
Astronautics
Astronomy
Astrophysics
Atmosphere
Aurora
Aviation weather
Boyle's law
Charts
Compasses
Density altitude
Discoverer program
Earth
Environmental research
  satellites
Explorer satellites
Geodetic satellites
Gravity
Greenhouse effect
Kosmos satellites
Latitude and longitude
Lightning
Lunar charts
Magnetic course
Maps and mapping
Mariner probes
Meteorology
Navigation systems
Navigation techniques
Oceanographic research
Orbiting observatories
Pilotage
Precipitation
Ranger
Sounding rockets
Surveyor
Van Allen belts
weather
Weather maps and charts

Weather satellites

ECONOMICS

Aerospace industry
Airports
Bush flying
Business aviation
Cargo aircraft
Commercial airlines
Commercial air transports
Crop dusting
Economic implications
Fixed base operator
Flight simulators
General aviation
Government contracts
Government in aerospace
Jet aircraft
Jumbo jets
Manufacturing
Production techniques
Program management
Supersonic transports
Utility aviation

GENERAL SCIENCE

Airplane
Astronomy
Atmosphere
Atoms
Barometric pressure
Bernoulli's principle
Bird flight
Clouds
Electricity
Energy
Engines
Fog
Galaxies
Helicopters
Jet aircraft
Launch Vehicles
Man in flight
Matter
Mercury program
Photography
Planets
Radio communications
Satellites
Saturn rockets
Space stations
Stars
Sun
Walk in space
Weather
Weather satellites

GEOGRAPHY

Bush flying
Cartography
Charts
Compasses
Course plotting
European aerospace activities
Latitude and longitude
Magnetic course
Maps and mapping
Photography
Photogrammetry
U.S.S.R. aerospace activities

GEOLOGY

Astrogeology
Geodetic satellites
Mountain, desert, and jungle
  flying
Photogrammetry
Ranger
Surveyor

GOVERNMENT

Aerospace industry
Air Commerce Act
Air traffic control
Apollo
Army aviation
Coast Guard aviation
Crash investigation
FAA
Federal Aviation
  Regulations
Flight service station
Government contracts
Instrument Flight Rules
Marine Corps aviation
Mercury program
Military aviation
Military space program
NASA
National Airspace System
National Transportation
  Safety Board
Naval aviation
Pilots and pilot certificates
Registration of aircraft
Visual Flight Rules

HEALTH

Aerospace medicine
Animals in space
Astronauts
Circadian rhythm
Drug effects
Environmental control systems
Flight physical
Food and nutrition
Human engineering
Hypoxia
Life-support systems
Man in flight

BEST COPY AVAILABLE

Manned spaceflight
Man-powered flight
Pressurization
Sensory deprivation
Spacesuits
Temperature control
Weightlessness

HISTORY

Ace
Air Commerce Act
Air raid
Altitude records
Autogiros
Balloons
Barnstormers
Battle of Britain
Biographies
Bomber aircraft
Bush flying
Commemorative stamps and medals
Desert Storm
Dirigibles
Distance records
Endurance records
First World War aircraft
Flying circus
Gliders
History of aviation
Korean War
Luftwaffe
Man-powered flight
Mythology
National Advisory Committee for Aeronautics
Rheims Air Meet
Science fiction
Second World War aircraft
Speed records
Vietnam War
Women in aerospace
World War I
World War II

HOME ECONOMICS

Fabrics
Food and nutrition
Interiors of aircraft
Spacesuits
Stewards and stewardesses

INDUSTRIAL ARTS

Aerial photography
Aircraft propulsion systems
Avionics
Electronics
General aviation aircraft
Generators and alternators
Interiors of aircraft
Manufacturing
Materials
Metals and metallurgy
Occupations
preventive maintenance
Production techniques
Refueling
Spacecraft design

INTERNATIONAL RELATIONS

Air defense systems
Air forces of the world
Berlin airlift
Commercial airlines
DEW line
Federation Aeronautique Internationale
Five Freedoms
International agreements
International Geophysical Year

International projects
Iran-Iraq War
Israeli-Arab Conflict 1967
Missiles
Political implications
Reconnaissance
Space law
Tracking systems and networks
United Nations

MATHEMATICS

Binary numbers
Celestial navigation
Course plotting
Cybernetics
Dead reckoning
Doppler navigation
Escape velocity
Information systems
Navigation techniques
Orbits and trajectories
Parabola
Telemetry
Weight and balance

MEDICINE

Acceleration
Aerospace medicine
Animals in space
Astronauts
Aviation medicine
Circadian rhythm
Closed ecological system
Decompression
Drug effects
Environmental control systems
Environmental simulators
Escape systems
Flight physical
High-altitude flight training
Human engineering
Hypoxia
Life-support systems
Man in flight
Manned spaceflight
Mercury program
Parachutes
Pressurization
Psychological factors of flight
Re-entry vehicles
Sensory deprivation
Space biology
Spaceflight training
Space medicine
Spacesuits
technological projections
Walk in space
Weightlessness
X-rays

METEOROLOGY

Air
Air masses
Atmosphere
Barometric pressure
Clouds
Convection currents
Earth science
Evaporation and condensation
Fog
Humidity
Ozone
Precipitation
Turbulence
Weather maps and charts
Weather satellites
Wind

PHYSICS

Acoustics
Aerodynamics
Aircraft propulsion systems
Airfoil
Airplane
Airspeed indicator
Alloys
Area rule
Astronautics
Attitude control
Automatic landing
Astrionics
Avionics
Bank
Bearing

Bernoulli's principle
Boyle's law
Carburetion
Center of gravity
Computers
Cryogenics
Crystallography
Doppler effect
Dynamic soaring
Electricity
Electromagnetism
Electronics
Energy
Engines
Escape velocity
Flight management
Fluid mechanics
Gas turbine engines
Ground-effect machines
Gyroscope
heat energy
Heat shields
High-lift devices
Hydraulic systems
Hypersonic flight
Inertial guidance
Infrared radiation
Instrument panel
Lasers
Launching
Lifting-body vehicles
Magnetic levitation (MAGLEV)
Maneuvers
Matter
Measurement of power
Metals and metallurgy
Newton's laws
Noise
Nuclear energy
Nuclear propulsion
Pitot-static system
Plasma
Power management
Radar
Radiation
Radio
Reciprocating engines
Rendezvous and docking
Robots
Rotating combustion engines
Sailplanes
Semiconductors
Shock wave
Solar cells
Solid-state physics
Space propulsion systems
Supersonic flight
Television
Temperature scales
V-STOL aircraft
Wind tunnels
Wings
X-rays

PSYCHOLOGY

Astronauts
Aviation medicine
Cosmonauts
Flying safety
Gemini
Human factors
Man in flight
Pilot training
Psychological factors of flight
Spaceflight training
Space medicine

SOCIAL STUDIES

Air defense systems
Air forces of the world
Airmail
Air taxis
Apollo
Army aviation
Atlas missile
Berlin airlift
Biographies
Blockhouse
Bombs
Careers
Cargo aircraft
Commercial airlines
Communications satellites
Crop dusting
Cybernetics
Demonstration teams
DEW line
Economic implications
Educational implications
Eurospace
European aerospace activities
FAA
Fighter aircraft
Fixed base operation
Flight (as passenger)
Flight test programs
Flying doctor services
Forest fire control
Gemini
General aviation
Gliders
Gliding
Government in aerospace
Hangars
Helicopters
Heliports
High-speed surface transportation
History of aviation
Homebuilt aircraft
Instrument flight techniques
Insurance
Interplanetary travel
Israeli-Arab Conflict - 1967
Jet aircraft
Jumbo jets
Kamikaze
Kennedy Space Center
Korean War
Launch facilities
Launch vehicles
Luftwaffe
Lunar bases
Lunar exploration
Manned Orbiting Laboratory
Manned spaceflight
Manufacturing
Mercury program
Military aircraft
Military implications
Military space program
Missiles
Mythology
NASA
Naval aviation
NORAD
Oceanographic research
Peenemuende
Polar flights
Police and fire services
Preflight training
Production techniques
Program management
Radio communications
Rescue and recovery service
Rockets and rocketry
Runways
Safety statistics
Sailplanes
Satellites
Saturn rockets
Search and rescue
Social implications
Space stations
Sport flying
Strategic Air Command
Supersonic transports
Systems engineering
Technological projections
Unidentified flying objects
U.S.S.R. aerospace activities
Utility aviation
Weaponry
Wind tunnels
X-series aircraft

SPEECH AND COMMUNICATIONS

Air traffic control
Communications satellites
Ground control approach
Morse code
Phonetic alphabet
Terminology of aerospace

The foregoing scope of aerospace material is adapted from Chapter 2: The Scope of Aerospace, by Raymond J. Johnson and Jean F. Blashield of the publication entitled: An Introduction to Aerospace Education, edited by Dr. Mervin K. Strickler, Jr. - see bibliography.

Careful study of the above material will illustrate that if one understands the inclusive scope of aerospace it is apparent that there is relevance to every possible educational subject or discipline and one or more facets of aerospace.

Clearly, the relationships between education and aerospace require careful study, analysis and understanding before curricular decisions can be made. As will be described later in this paper, there are many ways to design meaningful aerospace education programs.

One of the most widely used approaches, both historically and currently, is to relate the information, data, experiences, trends, scientific, mathematic, social, artistic and other facets of aerospace such as economic to regular existing subjects. In the past and currently, there are also many examples of utilizing some or all of aerospace as a specialized subject of study. Which approach used will be determined by each school and community. Many will use both approaches as they are deemed appropriate. One important point to note is that aerospace education can be used effectively without replacing any existing subject or discipline. However it will require relating traditional subjects to appropriate contexts of the many facets of aerospace.

Aerospace education is the logical, rational, systematic use of the many disciplines inherent in aerospace to serve as a central motif or thematic approach to the existing curriculum. It may also be an effective area of study in and of an educational offering as either a specialized subject or series of subjects. The most important point is to recognize that aerospace can be an effective means to educational ends. In fact, the career education implications of aerospace education are monumental.

HISTORIC EXAMPLES OF AEROSPACE EDUCATION

If one believes that the past is prologue, then the future for aerospace education programs is indeed most promising. It is surprising for many to learn that the first evidence of an aviation education class in the United States shows that in 1908, only five years after the Wright brothers flew in 1903, H. Lavonne Twining of the Los Angeles Polytechnic High School used aviation in his physics classes. This is truly remarkable when it is realized that the average time between scientific and technical developments and their entrance into an educational curriculum is often a generation. Following World War I there was increased interest in pioneering aviation throughout the country. During the 1920's there are documented examples of aviation education programs in some schools in every region of the country. One of the earliest examples was the widespread practice of designing, building and flying in contests a variety of model airplanes in formal school settings.

THE FIRST HIGH SCHOOL AND COLLEGE FLIGHT TRAINING PROGRAM

In 1925 the Galt, California schools had the first public school flight training program at the high school level. The flight training was also related to all of the other relevant school subjects. Although originally limited to the high school, by 1926 a junior college was added to the Galt high school and the flight training and aviation education were designed to begin in the junior year of high school and continue through the two years of junior college. Thus, the Galt school system aviation education program is an early example of both secondary and higher education use of aviation education. This is probably the first example of a tax-supported public institution offering flight instruction to students. By any reasonable measure this is surely the first aviation education magnet school in the United States. It was done by local community initiative.

CONTRIBUTIONS OF THE DANIEL GUGGENHEIM FUND

The earliest national efforts to design and carry out significant aviation education programs at the elementary, secondary and higher education levels were those stimulated by the Daniel Guggenheim Fund for the Promotion of Aeronautics. The far-sighted and visionary initiatives of the Guggenheims created an atmosphere for the early developments of aviation and aviation education that continue to this day. Following are just some highlights of those efforts:

> Harry F. Guggenheim, in 1927, as President of the Guggenheim Fund described its purposes as having four objectives:
>
> > To promote aeronautical education, both academic and general.
> >
> > To assist in the extension of fundamental Aeronautical Science.
> >
> > To assist in the development of commercial aircraft.
> >
> > To further the application of aircraft in business, industry and other economic and social activities of the nation.

THE FIRST NATIONAL COMMITTEE ON AVIATION EDUCATION

To carry out the first objective, the Committee on Elementary and Secondary education was established in 1927. Interestingly, school students of the day played the primary role in the creation of this committee. As an executive committee member of this educational group, Dr. Roland H. Spaulding, then of New York University, wrote: The Guggenheim Fund Committee originated "as a result of ... educators asking for material which could be used to satisfy the growing curiosity concerning aviation on the part of the boys and girls in the public schools." All of us owe a debt of gratitude to those students of the 1920's who asked their teachers for answers to questions the school systems could not provide. But that was not for long. Thanks to Dr. Spaulding's truly pioneering aviation education, or as it was then called, aeronautical education, the foundations of aerospace education were firmly built.

EARLY SIGNIFICANT AVIATION EDUCATION PUBLICATIONS

Among the seminal publications that were developed were: Problems of Aeronautics in the Schools (1929), Some Present Practices in Secondary Aeronautical Education (1930), and in 1928 Dr. Spaulding wrote: Books on Aeronautics - A Bibliography of Books Likely to be of Use in Elementary and Secondary Schools. There is not an extant similar bibliography as comprehensive as that of 1928. However, there are growing numbers of sources of contemporary aerospace education materials. In 1929, Dr. Roland H. Spaulding's title was Specialist in Elementary and Secondary Aeronautical Education at New York University. He was the first such specialist.

GROWTH OF AVIATION EDUCATION IN THE 1920'S

Events of an aerospace education nature increased rapidly from the early 1920's until the present time. Just a few illustrative highlights of the events and personalities involved include the following:

A World War I naval aviator, Finis E. Engleman, planned and conducted a course in aviation for teachers at Kansas City, Missouri Teachers College in the early 1920's. He was later Chief State School Officer of Connecticut and later President of the Association of American School Administrators.

In 1928 Ralph E. Pickett, Chairman of the Department of Vocational Education of New York University gave a lecture entitled: "Teaching Aeronautical Knowledge by Means of School Activities."

Dr. William F. Durand was a key figure in the early development of significant aeronautical and educationally related programs. He was an original member of the prestigious National Advisory Committee on Aeronautics (NACA) which was the predecessor of the National Aeronautics and Space Administration (NASA). He served as an aeronautical consultant to the government during World War I and World War II. While serving as professor of engineering at Stanford University in 1928, he was asked to talk to the annual conference of the Superintendents of Schools in Boston, Massachusetts. His topic was: "The Public Needs Aeronautic Education." This remarkable, historic talk was the first example of reaching school administrators from all of the nation on this important topic. In his talk Durand made the following major points:

> Aeronautics stands ready to offer to society and to the cause of human progress a service.
>
> The public is divided into two classes insofar as aeronautic services are concerned - those who render the service and those who receive it.
>
> Education for those rendering aeronautical service must be technical, professional, vocational.
>
> For the great public at large - those who receive aeronautical service - the education which is significant is that which will permit them to use wisely and sanely the service offered.
>
> There must be developed within the body of society at large something of what is implied in the newly coined word "airmindedness."

Charles Lindbergh's flight to Paris in May of 1927 stimulated unprecedented interest in aviation throughout the United States and the world and many aviation education activities, projects and programs were designed and carried out.

In 1930 the Aeronautical Chamber of Commerce, in cooperation with the Daniel Guggenheim Fund Committee on Elementary and Secondary Education conducted the First National Conference on Aeronautical Education in St. Louis, Missouri.

GROWTH OF AVIATION EDUCATION IN THE 1930'S

In April of 1931 a similar conference was held in Detroit, Michigan.

In 1932 the United States Office of Education had a bulletin entitled: "Vocational Training for Aviation Mechanics" published. Known as Bulletin No. 142, it was written by Robert W. Hambrook, Specialist for Trade and Industrial Education.

In 1936 the U.S. Office of Education published another work by Hambrook entitled: "Aviation in the Public Schools."

During the 1920's and 1930's newly emerging airlines employed educators to help further aviation education.

Western Air Express employed Professor Earl W. Hill of the University of Southern California. United Airlines employed a former college president, Dr. William A. Wheatley. These professional educators helped schools and colleges understand the relevance of aviation to education and designed, developed and published materials of instruction for students and teachers.

In subsequent years airlines such as Pan American, Trans World Airlines, American Airlines and Eastern Airlines used education oriented leaders such as Ray Mertes (UAL), Dr. John Furbay (TWA), George Gardner (Pan Am), Nicholas Englehardt and Kenneth Newland (AA).

The first formal federal legislation designed to promote or foster aviation was the 1926 Air Commerce Act. Current federal efforts to establish airports, provide air navigation facilities, establish airways and provide many other safety and educational programs stem from this activity that was then a part of the Department of Commerce.

In 1936 the Bureau of Air Commerce working with the National Education Association (NEA) published in the November issue of the Journal of the NEA a fifteen-page article on aviation education. The suggested activities and sources of materials were widely used by teachers all over the United States.

In 1938 the Civil Aeronautics Authority (CAA) evolved from the Bureau of Air Commerce that was established in 1926.

In 1940 the Civil Aeronautics Authority became the Civil Aeronautics Administration. The 1938 legislation and subsequent directives laid the foundation for the CAA to provide general development and promotional work on behalf of the newly emerging aviation system of the country. Aviation education programs and activities of the CAA and its successor FAA stem from the development and promotional facets of the 1938 legislation.

GATHERING WAR CLOUDS STIMULATE AVIATION EDUCATION

Events of the 1930's which led to World War II featured remarkable interest in and pioneering contributions to aviation education.

U.S. Office of Education Commissioner John W. Studebaker played a key role in calling the attention of members of Congress and the President and members of his staff to the strides being made both in Germany and the Soviet Union to provide aviation experiences for their youth with a view to motivating and training them to become pilots, mechanics and other aviation workers. In fact, Studebaker's interest and information helped provide the justification for the historic 1939 Civilian Pilot Training Program (CPTP), the largest peacetime pilot training program ever.

Commissioner Studebaker provided leadership for the publication of documents such as "Air-Conditioning Young American" (May, 1942) in which it pointed out, in part:

> "... to be air-conditioned means to be in a state of readiness to do something about aviation and not just feel strongly about it. The term, it should be made clear, does not imply vocational proficiency in some field of aviation. Rather, it means a saturation of the American people in aviation skills and a general comprehension of the significance of aviation."

This quotation is from Robert H. Hinckley, Assistant Secretary of Commerce for Air who co-authored the publication referred to with Commissioner Studebaker.

Studebaker pointed out the immediate (war-time) role of aviation in education and said, "...first, the immediate relationship of aviation education" is in the schools to meet "... wartime needs." "... second," we must be aware of "... the relationship of aviation education to the post-war world.

Studebaker said:

> "Aviation education is here to stay. Although military considerations must be given priority in a nation at war, the schools cannot overlook the fact that the impetus of war needs will also help to usher in a more comprehensive program of

> aviation education, long overdue in American schools."

He went on to say:

> "We have realized in the Office of Education for a long time the need to provide all possible stimulation and leadership in this important field."

Furthermore, after pointing out the urgent war-time need to prepare high school students for possible military roles in aviation, Studebaker said:

> "The objective for the longer future must be to make a functioning program of Aviation Education available to students in all secondary schools."

In early 1942, recognizing the need to greatly increase the supply of qualified potential aviation cadets for the military, Commissioner Studebaker authorized the publication of U.S. Office of Education Leaflet No. 62 entitled: Pre-Aviation Cadet Training in High Schools. This publication provided detailed course outlines and curriculum for a 1942 summer course of from 6 to 12 weeks in length and for a 4 to 6 week course for qualified high school seniors and recent graduates to be given before the end of the 1942 school term. Thousands of students participated in this effort.

In May of 1942 the U.S. Office of Education published Leaflet No. 63 which was a more detailed companion booklet to Leaflet No. 62 described above. This publication was entitled: Pre-Flight Aeronautics in Secondary Schools. It provided detailed course outlines for courses ranging from one to four semesters all designed to qualify students to be successful in actual flight training for the military. It was estimated there were 12,000 high schools that offered pre-flight aeronautics to a quarter of a million boys and girls.

WORLD'S LARGEST PILOT TRAINING PROGRAM

One of the largest aviation education programs designed to train pilots by ground school and pre-flight study followed by actual flight training took place during the period 1939-1944. From 1939 when it was started as the CPTP program, described earlier, until it became the War Training Service (WTS) after Pearl Harbor until it was completed in 1944 this project trained over four hundred thousand pilots for our military. As the Civilian Pilot Training Program starting in 1939 it made use of private aviation contractors, schools and colleges. The academic or ground school work was done by colleges and the flight training by private aviation firms. After we entered the war the entire program was taken over by the military and it continued until our military pilot requirements were met. One of the major accomplishments of this program was the qualification of many women and minority pilots.

The complete stories of the CPTP and WTS pilot training programs are told in the Federal Aviation Administration (FAA) publication entitled: The Putt-Putt Air Force. (See the bibliography.)

NEW AVIATION EDUCATION MATERIALS FOR TEACHERS

Up-to-date, understandable and technically accurate teaching materials were sorely needed for the war-time and post-war needs of teachers, schools and students. In 1940 two teams of writers started and produced 10 volumes of texts that were published by the U.S. Government Printing Office (GPO). More than one million copies of these were purchased for the CPTP and WTS programs. Meanwhile, two research groups were working to develop teaching materials for civilian schools.

In 1942 a massive research and writing project was started under the leadership of Nicholas L. Englehardt of Teachers College, Columbia University with a team of researchers and writers there and at the University of Nebraska. The team producing the materials that became known as the Air-Age Education Series was the Aviation Education Research Group. Their manuscripts were published by the MacMillan Company and were used during the rest of the war in many thousands of schools. In fact, they were used for many years after the war.

In 1946 Dr. Paul R. Hanna of Stanford University completed the massive research project that resulted in the 900 page volume entitled: Aviation Education Source Book. The book was designed to give teachers, curriculum consultants, textbook writers and aviation educators the materials for use in subject matter areas from kindergarten to the ninth grade.

TEACHER AVIATION EDUCATION WORKSHOPS BECOME POPULAR

Teacher education workshops were given emphasis during the war and from the post-war era to the present time. In terms of post-war pilot training the so-called veterans training legislation or G.I. Bill provided flight training to more than four hundred thousand veterans of World War II and nearly eighty thousand veterans of the Korean conflict.

In 1946 and 1948 the Civil Aeronautics Administration (CAA) in cooperation with the American Council on Education (ACE) conducted surveys of Collegiate Courses in Aviation and related fields. In 1946, 372 colleges reported programs and in 1948 there were 331.

In the early 1950's the CAA cut back its support and activities in aviation education including producing educational instructional materials and sponsorship of teacher workshops.

During the late 1940's and growing in the 1950's Civil Air Patrol (CAP) and the United States Air Force (USAF) expanded its interest in and support of aviation education. CAP produced high school texts and planned, and conducted national aviation education workshops for hundreds of teachers from throughout the nation. Additionally, from that time until the present CAP and USAF staff have provided assistance to hundreds of teacher education workshops each year.

On October 5, 1957 the attention of the world and U.S. government officials and educators were startled into massive educational efforts to reform and improve education in general, and science and mathematics study in particular. The first ever launch by man of a man-made satellite - Sputnik I - by the Soviet Union created near panic, consternation and high level and widespread motivation to re-examine the nature and extent of education in the United States.

With the creation of the Federal Aviation Agency (FAA) which later became the Federal Aviation Administration (FAA) and the establishment of the National Aeronautics and Space Administration (NASA) starting in the 1960's huge resources for aviation - aerospace education began to become available again.

During the last three decades more and more aviation and space industries have dedicated staff and resources to working with teachers and students. In many states, the Department of Transportation and/or Aviation Department provide advice, material and professional consultation to interested educators and students.

AEROSPACE EDUCATION MAGNET SCHOOLS AND EDUCATIONAL EFFECTIVENESS

While there is meager documentation of magnet schools or programs and how they have benefitted students, there are some exceptions.

One of the most significant aviation magnet programs based on flight that yielded documentary evidence of positive influences of the program on students is the Richmond United School District - of Richmond, California - known as Learning Through Aviation. The Richmond project is the first example of a program of aviation education designed to have a positive influence on students and use a control group to measure and compare educational and related goal attainment. The Richmond experiences and resulting data served to motivate many other school districts and communities to plan aerospace magnet programs and even entire schools.

(Much of the following information is adapted from the May, 1978 paper entitled: Learning Through Aviation by Dr. Mervin K. Strickler, Jr. and Charles L. Dobson of the Federal Aviation Administration.)

Basically, the so-called Richmond Project was:

> "... an innovative educational experiment which used a light, single engine airplane to generate basic instructional and behavioral changes in an inner city junior high school class. The flight project involved twenty-five disadvantaged area, thirteen year old boys and their parents, four regular staff teachers, two pilot instructors and a college student tutor."

Among descriptive characteristics of the group, the project personnel described the students initially as: low and underachieving, having negative self-perception and behavior problems, poor attendance, truancy, having a high rate of suspension and grades too poor to qualify for college entrance.

The Richmond authorities were interested in doing a research study to test the hypothesis that the use of actual flight and the associated study of regular class subjects in the context of preparing to fly, navigate, communicate could be verified as contributing to attainment of several worthwhile educational objectives. Thus the research study was designed with the following in view:

> "Research objectives included a determination of the value of the flight program in terms of increased motivation. That is, the extent the flight program succeeded in: 1)motivating the students to achieve academically; 2)motivating the students to attend school more regularly; 3) motivating the students to become involved a greater percentage of their classroom time in instructional and less disruptive and resistant behavior; 4) elevating the level of self-esteem and aspiration of the pupils; 5) improving the chances of higher education for the pupils; 6) altering the perception of the teachers and parents of these youths as regards their scholastic ability.
>
> The group selected for the flight program had the following characteristics: 1) all male; 2) 80% black; 3) average age 13.3 years; 4) a resident of the disadvantaged or 'target' area for a minimum of five years; 5) low and underachievement as assured by standardized tests and grades in academic subjects; 6) I.Q. scores ranged from a low of 78 to a high of 104; 7) one or more significant behavioral problems associated primarily with school, and/or family background. This group was matched with a control group at another junior high school.
>
> Experimental group students were found to range from average to below average in reading ability. In no case did any of the original group evidence a very good ability in reading."

The Richmond project is especially valuable because a control group of students was matched with the Flight Group.

The Flight Group, as evidenced by interviews as well as attitude testing, was characterized by: disaffection with school and the education system, low self-confidence, poor self-esteem, little faith in the future, a belief that teachers are prejudiced. The control group represented a nearly opposite series of beliefs.

By the end of the first year of the project, the researchers had concluded that their data and observations clearly demonstrated that the Flight Group students had:

- developed more positive motivation to achieve academically and make something of their lives.
- incurred fewer disciplinary problems than the control group.
- attended school more regularly and earned better grades.
- showed marked improvement in reading ability.

From the opening of the school year in September of 1967 until the Flight Group advanced into and through junior high and high school, it was clear that the project had a profound influence on each student. Details of these effects are spelled out in various reports on the project.

The real test of a program of this type is what happens to the students after graduation from high school. Fortunately, this data is available. In 1975, as a result of support by the Oklahoma State University Education and Research Foundation, the National Aeronautics and Space Administration Ames Research Center and the National Institute of Education, Sociologist and Evaluation Consultant Lee Conway did follow-up interviews with the Richmond Flight Group. His findings are reported in the May, 1976 Journal of Phi Delta Kappa. The article is entitled: Classroom in the Sky: A Power Trip for Disadvantaged Youth.

Conway's follow-up evaluation led him to conclude: "Remarkable transformation in the character and competence of these young men had occurred." The area of Conway's follow-up included:

- Academic progress
- Employment
- Self-Esteem
- Parental Backing
- Sense of Mastery

Conway's conclusions include the following (as reported in the May, 1976 article in the Phi Delta Kappan):

> "The many successes of the flight project and its unexpected positive results appear to be caused by the youths' involvement in a high-status activity, elimination of the fear of failure, changed expectations on the part of significant others in their lives, acquisition of unique skills, and the opportunity for significant achievement in the dominant culture.
>
> This longitudinal study has produced considerable hard data as well as qualitative results supportive of the flight project concept. Former project youths are demonstrably better off than controls in the areas of employment, advanced education and avoidance of deviance. Finally, project youths appear to have grasped the linkage between advanced schooling and career potential as their essential and available source of power.
>
> Flight brought a sense of joy to these youths and overcame their pervasive feelings of alienation and worthlessness. Their flight instructor's non-critical, non-threatening evaluation of their abilities gave them a sense of 'specialness' which overcame the judgmental, negative attitudes to which they had grown accustomed.
>
> Our evaluation data appear to prove that moral and imaginative capacity, not measured achievement or tested intelligence (I.Q.) are the real defining characteristics of human beings."

Clearly, the many ways in which this program touched the lives of students, parents, instructor and others associated with them is remarkable. However, the influences this carefully researched and documented program had on other schools and communities may well be of even greater significance described in the information that follows. The concepts that were so well planned and carried out in the Richmond, California schools starting in 1967 were spread to the District of Columbia school system as early as late 1968 and early 1969 and were used in Cardozo High School under the leadership of an imaginative teacher, Mrs. Bernice Thorpe.

AUGUST MARTIN HIGH SCHOOL - PIONEER AEROSPACE MAGNET

During 1968 in the borough of Queens in New York City members of the community including parents, labor, education, industry and government explored how they might use or adapt the Richmond school techniques to establish an entire high school as a magnet-aerospace-thematic program. The result of the study and research in New York pointed to the feasibility of establishing a high school with the entire educational program built around aerospace. thus, the joint planning efforts of the various groups resulted in a 1969 authorization by the New York City Board of Education to convert the old, traditional and increasingly ineffective Woodrow Wilson High School into a comprehensive high school with emphasis on air-transport and related aviation, space and transportation careers.

After two years of careful planning, the new school was opened in September, 1971. It was named August Martin High School. August Martin was one of the first black commercial airline pilots in the United States. He learned to fly in the CPTP-WTS flight training program described earlier. He was killed while he was a pilot in command of a volunteer relief flight to Biafra.

The original Woodrow Wilson School was a vocational school with 3,100 students when it was opened in the early 1940's. By 1965 its enrollment had declined to 810 students. Average daily attendance had declined from a high of 80% to 50% of the students attending daily classes. By the late 1960's students no longer took the State and Regional Examination in subjects based on city-wide tests in either academic, shop, or vocational courses. Parents, students, the Board of Education and the community knew that it was a school in name only.

One of the guidelines of the task force and planning committee that set out to plan and create a new comprehensive high school to replace the traditional vocationally oriented high school was to create an educational institution that would be exciting for parents and students, but with an innovative and educationally sound program. Thus, the committee adopted aerospace first, as a magnet to attract interested students from throughout the city and, second, because aerospace, by definition, provided an outline related to all facets of the academic and occupational or career programs that it was anticipated the new high school would offer its students.

Those responsible for planning the August Martin High School recognized that to be attractive the new school had to relate to the world of today and tomorrow while being tied to the real world of work. Thus it was decided to use aerospace as the central theme, motif or core running through the offerings. It is interesting to note that the August Martin planning committee was fully familiar with the landmark study that had been done with the Richmond, California Learning Through Aviation Project.

From the time August Martin opened, it has averaged a daily attendance of more than 90%. It ranks as the highest level academic secondary school in Queens. The student body is made up of 95% minority students of whom most are black. The students come from throughout the city and it is noted for rigorous entrance and performance criteria. Records show that August Martin students are achievers.

From a curriculum design point of view, all of the disciplines taught in the school are related, as appropriate, to aviation, space or transportation. Much more detailed information on this facet of the program may be found in the FAA publication entitled: A Model Aerospace Curriculum, August Martin High School which is listed in the bibliography. Excerpts from this publication describing community activities and the curriculum are included in the Curriculum Options and Models section of this publication.

The school is very near John F. Kennedy International Airport. Many of the aviation, industry and government agency people associated with this huge international aviation center work closely with faculty and students. While some students do get jobs at JFK International Airport, the majority of the graduates go on to post-secondary education.

Among the many agencies working with the August Martin faculty and student body since the school was started is the Aviation Development Council of New York City. This small non-profit group which works on behalf of various aviation interests works with the private sector, government agencies and the local community to foster aviation via education. Among their many successful projects that use the Learning Through Aviation approach is a special program that was done under contract with the Law Enforcement Assistance Administration (LEAA). In this program four hundred and fifty youths, ages twelve to eighteen, were given basic ground school instruction and actual flight instruction of up to ten hours. Each participant had been referred to the juvenile court system and, except for this program, would be processed through the usual correctional institutions.

The results of this program have been remarkable. Young people who had previously shown no interest in school or learning demonstrated an interest in mathematics and science as these are needed tools in learning to fly. At the time this program was conducted, the per youth cost of traditional juvenile justice handling of such young people was $14,000.00 per year. By whatever criteria one wants to consider, this approach merits widespread study.

The foregoing are just a few illustrative examples of what others have done based on the experiences gained and documented in Richmond, California in the program called Learning Through Aviation. Two other such examples of using that approach follow.

AN UPWARD BOUND LEARNING THROUGH AVIATION PROJECT

In 1974 Embry-Riddle Aeronautical University of Daytona Beach, Florida was awarded a contract by the U.S. Office of Education to conduct an Upward Bound Program using aviation as a motivational means of education. According to the final report of the Embry-Riddle project it was pointed out the overall goal of the program was to use aviation as a tool to motivate financially disadvantaged high school students to continue their educational experiences into post-secondary education.

The project group met on weekends using the university dormitories, classrooms, counseling and other resources. Actual aviation oriented studies were used to stimulate improvement in reading, mathematics and science skills. The 1974-1975 group included sixty-five students who met the criteria referred to earlier. Twenty-one of the group were high school seniors. At the close of the first year project, twenty of the seniors had been accepted for college and the remaining one received post-secondary technical training in the Air Force. Progress made in other areas included: 69% of the total group showed improvement in their school grade point average, 65% of the group initially showed reading performance below grade 9 level and 22% of this group raised their reading level by the end of the program, while 39% of the balance of the group raised their reading level by one year. These are clearly measurable results.

This program was continued in subsequent years in both the regular school year and in a summer program. In each instance, positive results were attained. In later programs, actual flying was a part of the program to provide a flying classroom application for ground studies. Impressive advances were made in language, communication, mathematics and science areas.

RANDALL AEROSPACE AND MARINE SCIENCE HIGH SCHOOL PROGRAM (RAMS)

One of the most interesting applications of the experiences learned from the Richmond, California Learning Through Aviation Program and the Jamaica, New York August Martin thematic program emerged in the District of Columbia in 1975. This project is an excellent example of how two themes may be used in designing and carrying out a magnet educational program. While many people contributed to the planning and operation of this program, the two prime movers were teachers in the school: Mr. Raymond L. Compton, Aerospace Director and Dr. Richard N. Podgorny, Marine Science Director. When the Program started, Randall school was a junior high school. After the first year of the program that was originally planned for the eighth and ninth grades the Board of Education decided to change the junior high school to a grade 9-12 senior high school. This transition complicated the already complex task of taking subject matter teachers and helping them learn appropriate aerospace and marine science contexts for their traditional disciplines.

Among the reasons for selecting the aerospace and marine themes for the RAMS program were: the location of the school which was within the traffic pattern of Washington National Airport and it was near the inner harbor of Washington, D.C. and near the Potomac River and the Chesapeake Bay. Further, teacher Raymond Compton was an experienced pilot and aircraft owner and Dr. Podgorny was trained in the biological sciences and oceanography; there was, nearby, the headquarters of the Federal Aviation Administration and their professional aviation education staff who had pledged consultant help to the school. A Deputy Superintendent of the D.C. schools encouraged the principal and the two key faculty to proceed with their ideas for the thematic magnet school. The U.S. Office of Education provided an ESEA Title IV grant to assist in planning and evaluation of the program.

One of the greatest outcomes of the RAMS project and some of the reasons it could function successfully was the help of community interests throughout the program. Among those regularly providing technical and other kinds of assistance were:

Federal Aviation Administration
National Capital Parks' Lightship Chesapeake
National Oceanic and Atmospheric Administration
Washington Metropolitan Police Department Harbor Section
National Transportation Safety Board
National Aquarium
Congressional Flying Club
U.S. Coast Guard Auxiliary
U.S. Navy
Civil Air Patrol - National Capital Wing
Tuskegee Airmen's Association - National and Washington Chapters
University of the District of Columbia Aerospace and Marine Science Departments
David W. Taylor Naval Ship Research and Development Center
National Red Cross
Kiwanis Club

The RAMS staff had fine community resources to help them. In fact, all successful magnet school programs make full use of available community resources.

One of the objectives of the RAMS program from its inception was to relate career opportunities to students. Follow-up studies of RAMS graduates suggest that this was an important and appreciated objective of the program. Those responsible for planning and evaluating magnet schools would do well to study the process and techniques that were designed for the RAMS program.

It is probable that RAMS had the best and most comprehensive Evaluation Studies done of any similar program. Dr. Isadore Goldberg, Principal Investigator of Creative Research Associates, Inc. of Silver Springs, Maryland designed and carried out 1977 and 1978 evaluations. His studies were part of the conditions of the grant money made available to the District of Columbia Schools. His studies were coordinated and developed for the Division of Planning, Research and Evaluation of the D.C. Schools. These reports were published and distributed by the Federal Aviation Administration Aviation Education Programs Division. For details of more magnet school evaluations, see the Section entitled: Evaluating Magnet Projects, Activities and Programs in this publication.

THE FUTURE FOR AEROSPACE MAGNET SCHOOLS

The November, 1991 Little Rock, Arkansas National Conference on Aerospace Magnet Schools bodes well for future aerospace magnet schools. Many excellent examples of such schools and programs were represented at the conference and their representatives generously shared their experiences - success as well as shortcomings and challenges. It is apparent that one of the newest aerospace magnet schools in the nation will be the one currently in the planning stage by the Little Rock School System. Hopefully, the Little Rock magnet school will build on the lessons learned from past programs and contemporary examples.

In one major way, Little Rock has some advantages over all of the other past and existing aerospace magnet school programs. When the Little Rock project becomes a reality - hopefully sooner rather than later - it will be unique among such projects.

When FAA Administrator James B. Busey visited Little Rock on April 12, 1991 he said, "This is the first time that a magnet school and an aviation museum have been planned together from the ground up. That's never been done before."

On November 20, 1992 at the Second Annual National Aviation Magnet School Conference, in Phoenix, Arizona, FAA Deputy Regional Administrator Fanny Rivera stated:

> "FAA sponsorship of this conference demonstrates our resolve to promote aviation in the classroom. It reinforces our commitment to foster the development of quality high school aviation programs.

> The interdisciplinary, thematic approach, one that uses aviation as the key which binds together - mathematics, science, language arts, social studies, history and art - can help forge new ways to motivate students to gain the most from their education."

All who have learned of the combination of cooperative interests in aerospace and aerospace education in Arkansas in general and the Little Rock area in particular realize that a truly historic educational innovation is underway. The nation's first aerospace education magnet school in conjunction with a first class aerospace museum will soon be a reality. A site for this joint enterprise has already been selected and it will be on the grounds of the Little Rock airport. When this new museum and school program start, it will serve as a national model of what a 21st century aerospace magnet education program could become.

"In both mathematics and science, a growing body of research documents that hands-on activities, problem solving, use of technology, and student-centered learning are the most effective ways to improve students' achievement and sustain their interest, yet most course work still relies predominantly on lecturing and reliance on textbooks."

"... those of you who have been involved in equity and in choice, especially with magnet schools, have accomplished a great deal. You are among those who have led the way out of the status quo. You have forged partnerships such as those which Little Rock, the Federal Aviation Administration and other concerned community and industry interests are developing with Little Rock's emerging aerospace magnet model."

Alicia Coro

SECTION V - FAA AND AVIATION EDUCATION
YESTERDAY - TODAY - TOMORROW

For more than thirty years FAA has had aviation education programs, activities and learning materials for students of all grade levels and for teachers. FAA aviation and educational specialists have worked with several hundred colleges and universities, thousands of school systems and dozens of aviation industries in designing aviation education programs that are appropriate to the educational institution or industry.

Today FAA's aviation education programs cover the spectrum of education from kindergarten through elementary, middle, high school, community/junior college and four year college (K - 12 - 16). In 1993, for the first time, all of the aviation education programs are located in one office in the Washington headquarters of FAA. They are a part of the Office of Training and Higher Education.

In 1978 FAA became interested in designing specialized post-secondary educational programs to educate its workforce of the future. In 1983, FAA received the approval of the Office of Personnel Management (OPM) and Congress to start a special college program. This is known as the Airway Science Program (AWS).

Following are highlights of details of the origins and present state of FAA's aviation education programs.

As described earlier in the section documenting historical events in the chronology of aviation education, the federal predecessor agencies to FAA planned and carried out a variety of important and pioneering aviation education programs that covered elementary, secondary and teacher education.

AUTHORITY FOR AVIATION EDUCATION PROJECTS AND PROGRAMS

Various statutory and policy statements have outlined the authority for and nature and extent of FAA aviation education programs. The Air Commerce Act of 1926 encouraged the federal government to "... foster the growth of civil aviation."

Events during the 1930's and leading to the Civilian Pilot Training Program (CPTP) grew out of Civil Aeronautics Administration (CAA) initiatives. The many aeronautic education programs during and right after World War II have already been described.

The 1958 Federal Aviation Agency Act charged the FAA to foster and promote the growth and development of civil aeronautics and air commerce.

By 1976, FAA was already a constituent agency of the Department of Transportation (DOT), and Congress passed legislation (Title 49 of U.S. Code, Section 134a) which provided:

> "In furtherance of his mandate to promote civil aviation, the Secretary of Transportation acting through the Administrator of the Federal Aviation Administration shall take such action as he may deem necessary, within available resources, to establish a civil aviation information distribution program within each region of the Federal Aviation Administration. Such program shall be designed so as to provide state and local school administrators, college and university officials, and officers of civil and other organizations, upon request, with informational materials and expertise on various aspects of civil aviation."

FAA AIRWAY SCIENCE CURRICULUM PROGRAM

The original idea for what is now the Airway Science Program (AWS), started with Mr. Lynn Helms, then FAA Administrator. As pointed out in the 1993 FAA publication, Airway Science Curriculum Proposal Information and Instructions, the program history is described in part as follows:

"The AWS Task Force was formed in 1981 at the request of Mr. Lynn Helms ... to design a generic curriculum for the proposed AWS program. The University Aviation Association (UAA) was asked to appoint Task Force members who would be representative of college and university programs throughout the United States. Because the AWS Program was a baccalaureate curriculum, the original Task Force represented institutions offering that degree. Shortly thereafter it was recognized that community colleges granting the associate degree might participate in the program by offering the lower division course work in the core curriculum. As a result, a community college representative was appointed to the Task Force."

On July 7, 1983, under the authority of Title VI of the Civil Service Reform Act of 1978, the Office of Personnel Management gave FAA final approval to proceed with its proposed: "Demonstration Project: Airway Science Curriculum."

As described in the Federal Register, Volume 48, No. 137, Friday, July 15, 1983, FAA "...has submitted a proposal for consideration as a demonstration project ... entitled 'Airway Science Curriculum Demonstration Project.'"

The FAA described this historic higher education project in the above-referenced Federal Register:

> "The purpose of the project is to compare performance, job attitudes, and perceived potential for supervisory positions of individuals recruited for several of FAA's technical occupations who have an aviation-related college level education, or its equivalent, with individuals recruited for the same occupations through traditional methods. In order to accomplish this purpose, FAA, with assistance from the University Aviation Association, developed a model Airway Science Curriculum which emphasizes college level courses in aviation, science and technology, mathematics, management, and general studies. Applicants for FAA positions as air traffic controller, electronic technician, aviation safety inspector, and computer specialist who enter through the demonstration Airway Science Announcement will be rated on their possession of the knowledges, skills, abilities, and other characteristics contained in the model Airway Science Curriculum and ranked and selected from a separate register parallel to those currently in use. Additionally, applicants for air traffic controller positions must pass the air traffic control examination, and applicants for aviation safety inspector must hold listed certificates and ratings."

The FAA higher education demonstration project was considered a success and after further development the Airway Science (AWS) Curriculum program was started. The goal of the AWS program is to develop a broad base of aviation technicians and managers for the FAA and private industry.

The AWS curriculum program was originally under the management of the Office of Personnel Management (OPM). It became an FAA operational program on December 31, 1990.

As of 1993, the program includes both two-year associate degree and four-year baccalaureate degree fields of study.

As of 1993 fifty-three (53) AWS programs are offered in colleges granting baccalaureate degrees in five areas of specialization. Not all colleges offer all five specializations. Six do. Others offer one to four. The five areas of specialization are:

- Airway Science Management
- Airway Computer Science
- Aircraft Systems Management
- Airway Electronic Systems
- Aviation Maintenance Management

Each program prepares students for success in a specific career.

In mid-1993 2,157 students were enrolled in the AWS curriculum program. The program is one way of helping FAA achieve diversity in the workforce - as of mid-1993 34% of the students were minority and 12% female.

In addition to the decade-old four-year college program FAA, in February of 1993, announced an associate degree (2-year college) program. Degrees are offered in three areas:

- Flight Technology
- Airway Electronics Technology
- Aviation Maintenance Technology

These two-year programs use a mix of technical and general courses similar to the four-year degree programs allowing community college students who have completed requirements for an associate degree to continue in a four-year program if they wish.

AIRWAY SCIENCE CURRICULUM DETAILS

The Five (5) AWS curricular offerings each have two major components. The first is known as the Core Subject Area and all five specialized programs include some of the same core subjects. Other core subjects are related to specialties such as those requiring mathematics, science, technology, computer science, management or aviation. They are:

Core Subject Area

General Studies	Semester Hours
English Composition	3
Oral Communication	3
Psychology	3
Humanities and Social Science Electives	15-21
Range of Credits	24-30

This area includes course work which teaches both oral and written communications skills. Specifically, written communication must include instruction in forms of expository writing. Oral communication skills include both formal and informal methods of verbal communication. In addition, course work relevant to this area will include instruction in the following topics: (i) the social, cultural, political and economic development of American and/or Western civilization; (ii) the study of human behavior; and (iii) the cultural aspects of knowledge such as philosophy, art, drama, music, literature, religion or language.

Math/Science/Technology	Semester Hours
Introduction to Calculus	3
Physics with Lab	6
Statistics	3
Electives	9-16
Chemistry required for Aviation Maintenance Area of Concentration	
Chemistry, Calculus II and Math Analysis required for Airway Electronic Systems Area of Concentration	
Calculus II required for Airway Computer Science Area of Concentration	
Range of Credits	21-28

This area is designed to familiarize students with mathematical concepts which may be essential to individuals functioning in a high technology environment. In addition, Science and Technology course work will instruct students in the application of the scientific method, an investigative approach which relies on the logical analysis of information. With regard to mathematics, topics should include college level algebra, analytical geometry, trigonometric functions, vectors and vector notation, matrix theory and applications, functional notation, basic integration and differentiation, linear equations and inequalities, elementary probability and descriptive statistics and linear programming.

In the area of science and technology, specific topics will include aspects of the physical sciences and general technology that have application to the aviation industry.

Computer Science	Semester Hours
Range of Credits	9 (or equivalent course work)

Requires nine (9) hours of course work in computer sciences or demonstrated equivalent course work taken outside of computer sciences that meets the knowledge and skill requirements listed below. The equivalent course work may meet other course work or elective requirements.

This area is designed to expose students to computer concepts and applications. Topics must include: (i) knowledge and use of a computer language and its application; (ii) database management; (iii) typical hardware configurations in use with micro and minicomputers; and (iv) software applications such as graphics or simulation.

Management	Semester Hours
(Minimum of six credits in upper division management courses required.)	
Principles of Management	3
Organizational Behavior	3
Electives	3-6
Range of Credits	9-12

This area is focused on instruction in basic management topics and concerns including organizations, employee motivation, interpersonal relations and general supervision concepts.

Aviation	Semester Hours
(Minimum of six credits in upper division management courses required.)	
Introduction to Aviation OR Private Pilot Lecture	3
Aviation Legislation	3
Aviation Safety	3
Aviation Electives	6
Range of Credits	15

This area is designed to provide an overview of aviation including the problems of flight, aircraft systems, the legal environment and safety.

General Electives	Semester Hours

Total sufficient to meet institutional graduation requirements.

Minimum semester hours for Core	80

AREAS OF CONCENTRATION (AOC)

The second component of AWS programs is referred to as an Area of Concentration (AOC). While all of the specialized degree programs have some of the same Core Subject Areas, each specialized program or Area of Concentration is different.

AIRWAY SCIENCE MANAGEMENT

This area of concentration prepares a student to pursue a variety of administrative and management positions; career options in the Federal Aviation Administration include Air Traffic Control Specialist. In the non-government sector, with this education and some experience, students may qualify for careers such as:

Air Carrier Manager
Airport Manager
General Aviation Operations Manager

Airway Science Management Courses	Semester Hours
Air Traffic Control System	3
Air Transportation	3
Airport Management	3
Personnel Management	3
Labor/Management Relations	3
Business Policies	3
Management Decision Making	3
*Psychology and/or Human Behavior and/or Communications Electives	9-12
*Aviation Management or Business Management Electives	9-12
Minimum semester hours for AOC	40

*Upper division level only

AIRWAY COMPUTER SCIENCE

In this area of concentration students learn to operate, design, troubleshoot and program computers used in aviation. Careers are expected to continue to expand in this new technology in areas such as:

Flight
Navigation
Communications
Information Processing
Computer Specialist

Jobs in the above categories are available both in government and the private sector.

Airway Computer Science Courses	Semester Hours
Computer Programming II	3
Advanced Computer Programming	3
Computer Operation Systems	3
Assembly Language Programming	3
Data Structures	3
Computer Methods and Applications I	3
Computer Methods and Applications II	3
Theory of Programming Languages and Complex Construction	3
Computer Architecture	3
Computer Electives	13
Minimum semester hours for AOC	40

AIRCRAFT SYSTEMS MANAGEMENT

This specialization concentrates on flying. It is designed to prepare professional pilots with a science and technology background. Students study aerodynamics, propulsion systems, aircraft structures and aircraft performance. Graduates have a Flight Instructor's certificate with airplane, instrument and multiengine ratings. They qualify to work for the FAA as an Aviation Safety Inspector (upon gaining some relevant experience). In the private sector they may be employed as:

Professional Pilot
Flight Operation Manager

Aircraft Systems Management Courses	Semester Hours
Private Pilot-Flight	2
Commercial Pilot Certification	5
Instrument Rating	5
Multi-Engine Rating	1
*Flight Instructor-Airplane	5
*Flight Instructor-Instrument Airplane	3
**Advanced Aerodynamics & Aircraft Performance	3
**Advanced Aircraft Systems	3
Meteorology	3
Air Transportation	3
**Aviation Electives (CFI Multi-Engine recommended)	6
Minimum semester hours for AOC	40

*Recommend upper division level
**Upper division level only

These graduates must hold a Commercial Pilot Certificate with Airplane Single and Multi-Engine Land and Instrument Airplane Ratings and a Flight Instructor Certificate with Airplane, Instrument and Multi-Engine Ratings.

AIRWAY ELECTRONIC SYSTEMS

This is a comprehensive study that combines electronic theories with practical experience. Students qualify for interesting work in aviation electronics such as:

Troubleshooting
Maintenance
Testing
Development

Graduates find employment either with the FAA or in the private sector as an Electronics Technician.

Airway Electronic Systems Courses	Semester Hours
Theory of Electronics	3
Microprocessor Theory and Application	3
Advanced Computer Programming	3
Solid State Devices	3
Integrated Circuits	3
Engineering Drawing	3
Electrical Circuits	3
Digital Logic Applications	3
Electrical and Power Principles	2
Electronics/Aviation Electives	15
Minimum semester hours for AOC	40

AVIATION MAINTENANCE MANAGEMENT

This specialty features an in-depth study of theories and hands-on practical study and demonstration of competence in airframe and powerplant maintenance. Graduates receive a Bachelor of Science degree and are qualified to work in either government or non-government positions in Maintenance Management and Troubleshooting. FAA may employ graduates of the program as an FAA Aviation Safety Inspector provided the person attained the FAA Airframe and Powerplant Maintenance Technicians Ratings. The curriculum must include all material to meet the minimum requirements for FAR Part 147.

Aviation Maintenance Management Courses	Semester Hours
Engineering Drawing	2
Aircraft Materials	2
Propulsion	6
Propulsion Laboratory	6
Structures	6
Structures Laboratory	6
Aircraft Systems	3
Avionics Systems	3
*Technical Electives	6
Minimum Semester Hours for AOC	40

*Upper division level only

These graduates must hold the Airframe and Powerplant Technicians Ratings (Mechanics).

In any of the five Airway Science programs, graduates must have:

Minimum semester hours for core area	80
Minimum semester hours for areas of concentration	40
Total Minimum Semester Hours for Graduation	120

WHAT THE AIRWAY SCIENCE PROGRAM DOES FOR FAA, INDUSTRY AND THE COUNTRY

As the FAA works with industry in designing and operating the National Airspace System (NAS) for the 21st century, it is clear that new approaches to personnel development must be taken. Thus, the Airway Science Program is an FAA aviation education partnership with the academic community. This partnership is forged to prepare technically qualified people for the thousands of jobs needed to support the modernization of all elements of the aviation system. Highly qualified people are needed in both industry and government.

New concepts for designing, developing and operating high technology equipment as well as creating efficient procedures and new ways of solving problems require a new type of individual. The 21st century employee must be one who can flourish in a culturally diverse, technical, scientific environment - a person who can think, plan, organize and manage machines as well as people.

The FAA started the Airway Science Program as one method of helping prepare the next generation of aviation technicians and managers for employment in government, industry and education. The results to date suggest the program is succeeding in meeting these national needs.

Any educational institution, industry, student or anyone desiring information about the Airway Science Program should consult the Resources Section of this publication.

HOW THE K-12 AND OTHER FAA AVIATION EDUCATION PROGRAMS RELATE TO THE AIRWAY SCIENCE PROGRAM

Specialists in career choice indicate that the earlier a child has an opportunity to become aware of any career field, the more likely a decision will be made to enter that field. Another facet of early career awareness projects and activities is that young people find careers that may be attractive as well as those they do not wish to explore further. FAA's aviation education programs, materials, partnerships with organizations and industries include emphasis on the wide range of aviation careers. FAA is currently reaching its broad-based aviation education goals via the programs and projects described below.

CURRENT FAA K-12 AND POST-SECONDARY AVIATION EDUCATION PROGRAMS

FAA continues a tradition of using a variety of activities, special projects and aviation education programs to reach young people and adults. The current FAA aviation education programs include:

1. Aviation Career Education "ACE" Academy (Secondary)

   ACE Academies are one-week summer aviation education programs for high school students co-sponsored by the FAA and host state organizations. This program provides students with a wide range of aviation career exploration experiences. Focus is on aviation career clusters identified by FAA, with emphasis on opportunities for women and minorities. The plan is to have one program in each state and U.S. territory. This program reaches 1,500-2,000 students each summer.

2. Federal Information Exchange (FEDIX) (K-12 - Post Secondary)

   FEDIX is an on-line computer-based information service that links the education community and the federal government to educational information services. FEDIX provides a complete agency organizational and program profile for university administrators, professors, teachers and students. Information on aviation education programs and resources available from FAA headquarters, regions, centers, and facilities may be included in the database. Details on aviation education initiatives of aviation industry and special interest groups are also available. FEDIX is linked to the Minority On-Line Information System (MOLIS) which features current data on all Historically Black Colleges & Universities and other minority educational institutions. FEDIX currently has 22,000 users, and 2,000 new users each month. Anyone with a computer and a modem can link up with FEDIX by calling 1-800-783-3349 and log in by typing "FEDIX."

3. Aviation Education Resource Centers (AERC) (K-12 - Post Secondary)

   Aviation Education Resource Centers function as information distribution centers for FAA aviation education materials and resources. They are used by educators, the media and the general public. Resource Centers are located at colleges, museums and state aviation authority offices. Resource centers maintain and provide quantities of FAA printed materials, videotapes and computer educational software. Center personnel also answer general information requests, conduct workshops and make aviation-related presentations. In 1993 there are 82 AERC's. It is planned to dedicate 25 additional AERC locations. This program reaches 100,000 educators and others each year.

4. FAA Aviation Education Volunteer Counselors (K-12 - Undergraduate and Graduate)

   FAA will select, provide orientation and appoint volunteer resource personnel to coordinate with headquarters, region and center aviation education officers to implement FAA aviation education programs. FAA volunteers are designed as official Aviation Education Counselors. Counselors assist FAA in promoting aviation education and fostering a wider knowledge, and better understanding of FAA, the National Airspace System and civil aviation in America. It is planned to conduct a counselor workshop in headquarters and one in each FAA region and center. Each volunteer counselor will be provided a specially prepared guide and other aviation education curriculum and guideline materials.

5. Government-Industry-Education Partnerships (All Levels)

   Industry partnerships such as with: General Aviation Manufacturers Association (GAMA), American Helicopter Society/Helicopter Association International (AHS/HAI), National Association of State Aviation Officials (NASAO), Aircraft Owners and Pilots Association (AOPA), Aircraft Electronics Association (AEA), National Air Transportation Association (NATA) and the Opportunity Skyway program increase public awareness and enhancement of the role of aviation and support aviation education programs at all levels of the educational system. These private sector/public or government education partnerships are increasingly important in working toward increased excellence in education. Each partnership yields additional resources to support the FAA's aviation program initiatives. In 1993, FAA plans to formalize six new industry and education partnerships.

6. National Congress on Aviation & Space Education - NCASE (All Levels)

In partnership with NASA and USAF-Civil Air Patrol, FAA participates annually by presenting teacher workshops and crosstalk sessions to exchange ideas on what is being done to promote aerospace education throughout the nation. The 1993 NCASE was held in Orlando, Florida, April 28 - May 1. FAA directed the 1993 NCASE. This program reaches 1,000-1,500 teachers and 25,000 students a year.

7. Aviation Magnet School Programs (Elementary and Secondary)

Magnet schools are a popular trend in elementary and secondary schools in America. They are excellent feeder programs for FAA's Airway Science Programs. Several Aviation Magnet Secondary schools have been funded by the U.S. Department of Education. In 1992, FAA administered the first Aviation Magnet Secondary Grant Program directed by Congress. In 1991 and 1992 FAA planned and conducted the first two National Aviation Magnet School Conferences and will conduct the third in November, 1993 in Louisville, Kentucky. These conferences provide an opportunity to exchange information and curriculum planning on a nation-wide basis. In 1993, FAA published a guide to planning aviation magnet activities, projects and programs that includes sample programs of middle schools and high schools. This publication provides models for any school system to modify or adapt.

8. DC-3/Flying Classroom/Simulator Program (Public)

The vintage DC-3 aircraft, N-34, provides an educational static display at airshows and communities across the country. the exhibit now demonstrates the new microflight simulator and software. The Flying Classroom program will eventually provide schools with surplus FAA computers. This program reaches over a million people a year.

9. Aviation Education Workshops for Teachers (Graduate & Undergraduate)

Principal focus is to provide teachers with information on FAA's aviation education programs and materials and to prepare them to teach aviation in the classroom. Workshops are conducted by approximately 250 colleges and universities annually. FAA provides information, materials, and/or speakers to each program. Counselor workshops are conducted at selected teacher workshops.

10. Adopt-A-School Program (K-12)

The Adopt-A-School partnership in education program encourages FAA personnel to get involved to share personal knowledge and aviation experience with educators and students. The program matches aviation skills, expertise, knowledge and resources of FAA with the needs of the educational objectives of local schools. FAA is identifying adopt-a-school locations in each region. This program reaches an estimated 25 schools a year.

11. International Science and Engineering Fair (Secondary)

FAA is a co-sponsor of this prestigious annual competition for more than 700 students from the United States and some other countries. FAA is joined by several aviation organizations such as the Airline Pilots Association (ALPA), Air Transport Association (ATA), Air Traffic Controllers Association (ATCA), Aircraft Owners and Pilots Association (AOPA) in providing scholarships and awards that recognize the achievements of high school science and engineering projects. (This program is managed by the FAA Technical Center in Atlantic City, New Jersey. See Resources Section of this publication for address information.)

12. International Aviation/Space Art Contest (K-12) (Ages 5-16)

Each year FAA cooperates with the National Aeronautic Association (NAA), the National Association of State Aviation Officials (NASAO) and the International Committee on Aviation and Space Education of the Paris, France-based Federation Aeronautique Internationale (FAI). Students ages five through sixteen may participate in categories related to their age level. National and international awards are given. Students from the United States regularly compete successfully for some of the international awards.

13. Aviation Science Instruction Program (ASIP)

This is an aviation education computer software program for students in grades six to eight. It is designed to inform and to help motivate students to study science and mathematics. ASIP uses an Apple II computer with the programs written in BASIC. The educational benefits of this material include using the computer to illustrate programming, graphics display methods and simple animation techniques. ASIP includes programs on three important topics:

Navigation and Flight planning
Principles of Flight
Aviation and Our Environment

This program is available to school systems only from the FAA Aviation Education Resource Center (AERC) at University of North Alabama, UNA Box 5145, Florence, Alabama 35632-0001, (202) 844-2434.

14. Air Bear Program (K-2)

This is a national partnership program done in cooperation with FAA, NASAO, the women's pilot organization known as the Ninety-Nines and the state of Illinois Division of Aeronautics. The program is designed for children in kindergarten through second grade. Students go on an imaginary flight to Disneyland when the "Air Bear" visits a classroom. Information on this program is available from FAA Regional Aviation Education Offices (see Resources section for nearest office).

FAA'S AVIATION EDUCATION PROGRAMS LOOK TO THE FUTURE

The foregoing represents brief highlights of FAA's current aviation education activities. Basically, FAA recognizes that the 21st century National Airspace System (NAS) will be designed, operated and maintained by a highly skilled, technically and scientifically literate workforce of culturally diverse people. Educators, representatives of aviation and related industries, organizational and local, municipal, state and federal officials who see the need for new aviation education initiatives or who know about educationally attractive programs for students and teachers should communicate with FAA for possible opportunities to cooperate.

FAA officials have always known they have a responsibility to work with educators and all elements of the public to help everyone understand the nature and the extent of the nation's aviation system. Furthermore, FAA plans to seek ways to help improve safety and to make education even more meaningful and effective by using appropriate examples of aviation education in helping schools and colleges, as resources permit. In the process, educational excellence and a safe, efficient, economical national system of air transportation will result.

"Aerospace magnet programs are a promising development that can have a real impact on meeting ..." the goal to "... seek to place the United States first in the world in mathematics and science achievement."

Alicia Coro

SECTION VI - CURRICULUM MODELS

Anyone interested in planning an educationally sound aviation education program that is relevant for preparing young people to deal with issues, be literate and introduced to various aviation, space, transportation careers will be well advised to consult the following programs. These range from historic early programs that have worked for many years to recent programs designed as magnet schools to help resolve problems of racial and ethnic imbalances and segregation as spelled out in federal standards.

All four of these programs are, in the full and literal sense, magnet programs. They all attract students. Furthermore, they have in common the fact that they work.

AUGUST MARTIN HIGH SCHOOL

In the early 1940's, Woodrow Wilson Vocational High School was opened in the Baisley Park section of Queens, New York. By 1948, the Woodrow Wilson School had more than 3,100 students in a main building and three annexes. Within seventeen years, by June, 1965, enrollment had declined to 802 students officially listed on the rolls. Average daily student attendance had also declined from a high of over 80% to only approximately 50% of the students enrolled attending classes daily by the late 1960's. Woodrow Wilson High School students no longer took the State and Regional Examination in subjects based on city-wide tests in either academic, shop or vocational courses.

In the late 1960's, parents, leaders from the aviation industry, community organizations, labor, and education formed a committee to see what could be done about the deteriorating Woodrow Wilson Vocational High School. It should be noted that the high school was located near John F. Kennedy International Airport; thus, the representatives of the aviation industry had an interest in helping assure that the program offerings took advantage of the rich vocational career and academic offerings of aviation. The key aviation leadership for evaluating Woodrow Wilson High School was provided by the Aviation Development Council of New York City. This organization represented the principal airlines and related aviation industries in the greater metropolitan New York area.

The committee, looking at solutions for remedying the problems at Woodrow Wilson High School, determined that a dramatic change had to be made. Thus, on October 3, 1969 this committee obtained a resolution from the New York City Board of Education permitting "the conversion of Woodrow Wilson High School into a comprehensive high school with emphasis on air-transport careers."

Immediately following this official action, a planning committee was created by the community of interests outlined above and a set of sub-committees was established to work on such topics as curriculum development, administrative selections, industry union relationships, work-study opportunities, needed plant expansions, program development, staff training, and public and community relations. The planning committee and the various sub-committees spent nearly two years of detailed intensive planning to create the new school.

One of the guidelines of the task force and planning committee was that the new comprehensive school in Queens, New York, designed to replace the traditional Woodrow Wilson vocationally oriented high school, would be exciting for parents and students, but with an innovative and educationally sound program. Thus, the committee adopted aerospace first, as a magnet to attract interested students from throughout the city and, second, because aerospace by definition provided an outline related to all facets of the academic and occupational or career programs that it was anticipated the new high school would offer its students.

Rationale for an Aerospace Thematic School

Those responsible for planning the August Martin High School recognized that to be attractive the new school had to relate to the world of today and tomorrow while being tied to the real world of work. Thus, the group decided to use aerospace as the central theme, motif, or core running through the offerings.

THE AUGUST MARTIN PROGRAM

A Comprehensive High School

August Martin is a comprehensive high school. In the ninth and tenth grades, pupils take a heavy concentration of academic subjects. In the eleventh and twelfth grades they have an opportunity to continue in either college preparatory, business career, or aerospace occupational programs.

Curriculum

In the ninth and tenth grades, all students take the five major subjects (English, Social Studies, Science, Algebra and Foreign Language), plus Practical Arts (Ninth Grade), Typing (Tenth Grade), Independent Study, and Health Education.

In the eleventh and twelfth grades, students may follow either of the following tracks.

- The College Preparation Course - continue academic subjects and electives, or

- Business Education Program - training in Accounting, Secretarial Work, or Data Processing. In addition, Martinites will have the chance to take Business Management, Passenger Servicing, Marketing, Advertising, etc., or

- Occupational Training in such aerospace fields as: Maintenance and Repair of Ground Support Vehicles, Avionics, Airport Maintenance, Flight Planning and Instruction, Aerospace Design, Aerial Photography, Aerospace Medical Technology, Travel and Tourism, Meteorology, Pre-Flight Attendant Training, Federal Aviation Laws and Regulations.

Comprehensive Guidance Program

In seeking to help students make critical decisions regarding course selections, the school provides the following:

- Four guidance interviews a year for each student.
- Group guidance sessions.
- A concentrated tenth-grade program.
- Career Day.
- College Night.

INNOVATIVE FEATURES

Administrative Features

The August Martin Advisory Commission and administration have sought to institute in the school tried and tested innovative administrative and curriculum features. Among the school's special administrative features are:

- A nine-period day of seven hours for all students (40 minutes longer than that enjoyed by almost all New York City high school students).

- A four-cycle year (school is reorganized four times a year when students receive new programs).

- Modular scheduling (time blocks of two or three 20-minute modules to permit a variety of teaching techniques).

- Students have a different program every day of the week.

- A computer terminal, tied to the University Application Processing Center, provides the school with daily attendance information, cyclical scheduling, personnel information, etc.
- Contract or free busing to transport students living in the extremities of Queens and Brooklyn.
- A daily bus for field trips to JFK Airport and the city's resources.

Curriculum Innovations

Among the curriculum innovations are:

- Students take sequential subjects like mathematics and foreign language at different levels (4, 6 and 8 cycles).
- All students take Elementary Algebra and Foreign Language.
- All sciences have a lab period.
- All students take Practical Arts courses in the ninth grade.
- All students take Typing in the tenth grade.
- All students are required to take a cycle of the Principles of Flight (Science) and the Air Age (Social Studies) in their freshman year.
- After completing required courses, students may choose from a wide variety of hundreds of mini-courses.
- Independent Study, a part of every pupil's daily program, affords pupils an opportunity to take a Master Kit for either advance or repeat work under supervision and to obtain tutorial help. The school operates six resource centers and a multi-media library as part of the Independent Study program.

AEROSPACE ACTIVITIES

Supplementary to the school's aerospace curriculum, August Martin High School has developed special activities and programs which reinforce and expand upon the school's central magnet concept. Several of these activities are described below:

Construction of the Wright Flyer Replica

In 1976 August Martin High School and the Port of Authority of New York and New Jersey were involved in a unique bicentennial celebration activity. With assistance from the Port Authority, the students and staff of August Martin High School constructed a full-scale replica of the original "Wright Flyer" from blueprints supplied by the Smithsonian Institution. The flyer was the airplane in which the Wright Brothers - Wilbur and Orville - demonstrated the feasibility of heavier-than-air aircraft in flight (December 17, 1903, at Kitty Hawk, North Carolina).

Constructed in one of the school's new shops, the plane (with a wing span of forty feet) was exact in every detail except for a simulated engine. The fabric and wood were treated to simulate the aging process of the original plane. The new vehicle had to be built in sections so that it could be transported from the school's shop to the International Arrivals Building at John F. Kennedy Airport. There it was reassembled; it replaced the huge Calder mobile that had been suspended from the rotunda ceiling at the International Arrivals Building.

In a dedication ceremony held at Kennedy Airport on June 11, 1976, the Wright Flyer was officially installed for all visitors to see. In addition the students and staff constructed a four-panel picture story depicting the story of the Wright Flyer replica project from its conception to the dedication; this was also placed on display on the mezzanine floor of the International Arrivals Building at John F. Kennedy Airport.

Flying Program

August Martin High School has conducted an ambitious flying program for its students since 1973. Started with Law Enforcement Administration funding and in cooperation with the State University at Farmingdale, the project has been continued with the aid of a mini-grant and federal funding. Students in the program have been organized into three main groups: beginners, intermediates and advanced.

A licensed pilot and flying instructor has been conducting the ground instruction courses at August Martin High School as a regular part of the school's curriculum. Qualified students have been taken to the State University at Farmingdale where the university's instructors have given them simulator time. They then take their flying lessons in university-owned planes at nearby Republic Airport. In 1977, some 140 martinites had an average of six hours flying experience.

Both in June and January of each year, students have been encouraged to take the FAA private Pilot's written examination. Students also have purchased flight jackets bearing the words Martin Pilots on the back. Several students have soloed, although the program's main aim has been to emphasize its motivational values in improving pupils' reading, mathematic, and learning skills.

Civil Air Patrol

In 1977 a Civil Air Patrol squadron was formed at August Martin High School. On March 21, 1977, a table of organization was developed and officers selected. To date, some fifty students have joined the squadron. The officers plan to gradually increase the membership and hope to soon have at the school one of the largest squadrons in the New York City area.

Among the program's objectives are the following: training and instruction in aerospace education, civil defense, aircraft search and rescue, and customs and courtesies. Students' continued participation depends upon their response to the program's educational and disciplinary requirements and their ability to work up to capacity.

Inflight Excursions and Apollo 16

Before the fuel shortage crisis, every freshman had an opportunity to take part in an airborne geography-geology lesson over the metropolitan area in a 707 jet paid for by both American Airlines and Pan American World Airways. The trips generally took the students across Long Island and the Sound, up into Connecticut, above the Catskill Mountains, along the Delaware Water Gap and the Jersey shore, and then above the lower part of Ne York City. The ship's captain provided the pupils with pertinent information regarding the principles of flight and pointed out landmarks as well as geographical and geological features.

In 1972, with the help of the airlines and the Aviation Development Council, the school was able to send a group of students to Cape Canaveral for a special tour of the facility and to witness the launching of Apollo 16.

THE ANNUAL P.T.A. MEETING AT EASTERN AIRLINES

August Martin High School has been fortunate to have had an outstanding Parent-Teachers Association. One of the highlights of its annual program has been the general membership meeting that has been held at Eastern Airlines Terminal, John F. Kennedy Airport. Each year between 250 and 300 parents and staff members have met at Eastern Airlines to hold a brief business meeting, hear presentations by the school's musical groups and listen to a special guest speaker.

The speakers, all of whom have played an important part in helping to launch an sustain August Martin, have included: Paul Gibson, Jr., Vice President of American Airlines and former New York City deputy Mayor; James Plinton, Jr., Vice President of Marketing at Eastern Airlines; and Donald Burns, Assistant Manager for the Port Authority. These memorable evenings have concluded with refreshments and champagne provided by Eastern Airlines.

PORT AUTHORITY ACTIVITIES

Annually, August Martinites have taken part in the Port Authority's Operation Safety. The students have acted as the "victims" in a simulated plane crash staged by the Port Authority at John F. Kennedy and La Guardia Airports. The August Martin Band also provided the music at the Pan American Airways Dedication of the 747 Clipper Lindbergh at its Fiftieth Anniversary Celebration of the Lindbergh Flight on May 20, 1977.

USING JOHN F. KENNEDY AIRPORT FACILITIES

One of the factors that made the adoption of an aerospace magnet logical and natural at August Martin High School was its closeness to John F. Kennedy Airport. The school has a bus available daily to take classes to the J.F.K. facilities. For example: language classes visit Air France and Iberian Airlines; career education groups are taken to Allied Maintenance, the Pan American Airways shops and the Federal Aviation Administration Air Route Traffic Control Center; and business education classes visit the administrative offices of various airlines.

DC-10 DEDICATION

On April 10, 1975, the school dedicated its new DC-10 facility and honored those individuals who had been responsible for helping the school secure and install a mock-up of the passenger section of the DC-10 aircraft. Mr. Paul Gibson, Jr. was instrumental in obtaining the facility from the McDonnell-Douglas Corporation in California. The crated sections and equipment were shipped by naval transport through the Panama Canal to the Bayonne Military Terminal. The crated facility was then transported on four flat bed trucks, first to the American Airlines cargo center and then to the school.

In order to get the three huge sections into a second-story room, a whole section of wall had to be removed. The borough shops then assembled the entire mock-up, which is complete from the galley facilities down to the carpeting. The mock-up has been used for orientation, meetings and classes.

AEROSPACE CAREERS DAY

Periodically the school, with the help of its Guidance Department, has organized a Career Day. Students, parents, guests and staff members attend some 25-30 career workshops that are conducted by personnel from the aviation industry. The event generally is followed by a luncheon prepared and served by the teachers and students for the guests and staff.

DEPARTMENT OF TRANSPORTATION AWARD

In 1973, August Martin High School was the first school to receive the John A. Hanson Award designed "to acknowledge achievement and to encourage outstanding public service in the field of transportation." Nominated by the Eastern Region, Federal Aviation Administration, for the coveted "Department of Transportation ,New York Field Coordination Group Annual Unit Award," the school was selected because it had "become an asset to the community through its innovative and imaginative approach to education" and had implemented its "philosophy of 'learning through aviation' ..." At a banquet held on Governor's Island on Friday, November 30, the presentation was made.

STUDENTS STUDY THE EFFECTS OF TOURISM ON THE CARIBBEAN ECOLOGY

In 1972 and 1973, with the help of the airlines and Dr. Towle, President of the Island Resources Foundation, groups of students were sent on trips to the Caribbean Islands to study the effects of tourism on that region's ecology. The experience was both recreational and educational. The pupils were given orientation and training sessions, visited mangrove swamps, studied underwater life, visited the botanical gardens and national park, given snorkeling and scuba-diving lessons and taken on plane and boat rides.

SPECIAL GUEST AT AUGUST MARTIN HIGH SCHOOL

Periodically, notable guests particularly interested in August Martin's aerospace program, have visited the school. On October 13, 1972, the school hosted a group of educators and officials from Washington, D.C., led by Dr. Mervin K. Strickler of the Federal Aviation Administration. The visitors were guests at a special assembly held for the occasion. This assembly featured a talk by Mr. Lloyd Haynes, then star of the television series, "Room 222," and a question-and-answer session. The following Friday evening's "Room 222" show was very timely entitled "Lift, Thrust, and Drag," and it dealt with the use of aerospace to motivate students. It also mentioned the Richmond, California experiment and August Martin, the man.

On April 24, 1974, Mr. Charles Dobson of the F.A.A. flew five educators from Washington, D.C. to visit the school. On February 10, 1975, a distinguished group of educators from Yale, Clark and Stony Brook Universities, led by noted Yale University psychologist, Professor Seymour Sarason, spent a day at August Martin High School. Representatives from the three universities, who were involved in the "Project Network," adopted August Martin High School as the special inner-urban school for study.

This relationship eventually led to August Martin's involvement in the Stony Brook "Minorities in Engineering Program."

On February 25 and 26, 1975, August Martin, because of its aerospace theme, was selected as the host school for the annual evaluation meeting of the National Advisory Committee involved in the Transportation Curriculum Project for the U.S. Office of Education. Eventually, August Martin staff members also became involved in the national curriculum project.

The above are illustrative of the many ways August Martin School has attracted visitors, scholars and resource persons who have taken elements of the program back to their own locale. Also, such visits have helped prompt offers of cooperation from many sources of assistance to the August Martin program.

THE AUGUST MARTIN AEROSPACE CURRICULUM

AEROSPACE CURRICULUM MATERIALS

This section includes highlights of the various curricular approaches used by August Martin faculty and staff. The material is excerpted from the publication entitled: August Martin High School Program with Special Emphasis on Aerospace Education, Dr. Lawrence Costello, August Martin High School. The areas covered are:

English
Social Studies
Mathematics
Foreign Languages

Science
Music-Art
Health Education

Included are curriculum materials developed by the school's department chairmen around the August Martin aerospace theme. It includes a statement of each subject department's aerospace education philosophy, samples of model lessons and instructional materials. The pages represent only a small part of the whole body of aerospace instruction matter that the school has prepared since its opening. Teachers are urged to use the material whenever applicable or relevant to a lesson. It should be noted that certain aerospace courses, such as "Principles of Flight" (Science) and "Air Age" (Social Studies), are required of all students.

Despite the importance of the central theme to the school's program, August Martin High School has found it increasingly advisable to introduce curriculum materials from areas closely related to aerospace, such as science and technology (the August Martin Institute of Science and Technology, or AMIST) and communications (August Martin Communications Center).

The following chairmen of academic subject departments have helped to develop the materials found in this section:

English	Noel Kriftcher Natalie Greenberg Steven Feldman
Social Studies	Arthur Kesselman Frederick Haines
Mathematics	Harold Bacon
Foreign Languages	Samuel La Rocca
Science	William Bush
Music-Art	Rosemarie Castanza
Health and Physical Education	James H. Kearney

THE USE OF THE AEROSPACE THEME IN ENGLISH

The aerospace theme in the English/Communications Department is incorporated in an indirect manner. Preparing students for basic competency in communications skills requires a multitude of courses which are tailored to students' interests and abilities. Realizing, however, that many young people have chosen to attend Martin because of its aerospace theme, several references to aviation and its tangible fields have been incorporated within the English curriculum.

The following list represents some of the aerospace-related features of English study at August Martin:

1. Vocabulary building lessons which include aviation-oriented words.

2. A communications studio which instructs students in the use and understanding of film, television and radio - the communications media of the air age.

3. Implementation of a Career Bridges and Work Experience Program which places students in aerospace-related external learning situations.

4. Special English course work within the AMIST Program.

5. A course in College and Career Experience which prepares students for standardized examinations which they will be called upon to take during their high school careers.

Sample Lesson Plan

"An Irish Airman Foresees His Death" - Yeats

AIM: To learn how the airman views death.

MOTIVATION: How many of you have ever seen a plane from World War I? Would you want to fly one? Why? Why did the pilots of WWI go up in those planes?

We're going to read a poem in which an airman expresses his feelings about being up in one of these planes. Let's look at the poem together and see if we can determine the pilot's attitude toward this dangerous work.

DEVELOPMENT: 1. In the first line, the airman uses the word "fate." What does he mean by this? (death)

2. Why does he consider death his fate? What does this tell us about his attitude towards flying?

3. What are the reasons this airman gives for going to war?

4. How does he feel about those he is fighting? How does he feel about those he is guarding?

5. What does the airman mean by the last three lines of the poem?

SUMMARY: How does the airman view the possibility of his own death?

APPLICATION: If you were a fellow airman of the speaker in this poem, how would you feel about his attitudes toward flying? Those he defends? Those he fights? Would you try to make him change his mind? Why? Why not?

Aerospace Theme in Written Communications

CYCLE II

Course Title: WRITTEN COMMUNICATION II (Effective Expression In The Flight Age)

Mandatory for all pupils, however, each student will be programmed into one of the three courses listed for this cycle. The student will be recommended for the course which best meets his needs based upon an ongoing ten-week evaluation of his weaknesses and strengths in the areas of composition and interpretation of literature. Since students will return to heterogeneous groups for Cycles III and IV, in Cycle II the difference between the courses will be based upon the depth and sophistication with which the material will be approached. All students will study, basically, the same material.

English 132 - English Essentials Workshop - for students who need assistance in developing basic writing and interpretive skills.

English 122 - Developmental Writing Workshop - for students who need assistance in organizing their ideas in composition writing and in developing their skills in narration, description and persuasion.

English 192 - Creative Writing Workshop - for students who need assistance in attempting a wide variety of creative writing activities.

Basic Areas of Study:

I. Introduction to a Variety of Literary types Through Reading

    A. Short Story
    B. Essay
    C. Poem
    D. Play
    E. Biography (and Autobiography)
    F. Novel
    G. Account of True Experience

II. Vocabulary and Spelling

III. Oral and Written Interpretation of Literature

A. Flight Age Problems
B. Analysis of Written Styles and Techniques

IV. Written Communication (Dependent upon the course in which a student is enrolled)

A. The Diagnostic Composition (no numerical grade to be issued). For criteria, see Cycle I

B. Short Exercises for the Following Skills:

1. The Narrative
2. The Descriptive Passage
3. Supporting an Opinion
4. Persuading a Reader
5. The Character Sketch

C. Creative Writing Exercises - short story, poem, essay

D. Written Report (based on outside reading of a full-length literary work)

NOTE: Readings are to be selected from the required textbook provided for the course (Composition: Models and Exercises). Supplementary readings (short stories, essays, excerpts from longer works) are to be selected by each teacher to provide models for class discussion of writing techniques and communication of ideas. Ongoing in-class discussion based on readings and events are essential to exchange of ideas by students. Such concepts as critical listening (and thinking), and respect for others' points of view are to be taught and emphasized.

During Cycle II, the following topics will be studied (based on titles provided by the textbook):

1. Skills of Descriptive Writing
2. Using Sensory Details
3. Skills of Narration
4. Selecting Events
5. Using Narrative Details
6. Using Dialogue
7. Point of View
8. Organization In Exposition
9. Description in Exposition
10. Narration in Exposition
11. Supporting An Opinion
12. Persuasion
13. The Character Sketch

14. Sentence Skills
    a. Variety in Sentence Lengths
    b. Parallel Structure
    c. The Compound-Complex Sentence
    d. Gerund Phrases
    e. Appositives
    f. Sentence Skills in Combination

SUPPLEMENTARY READINGS - CYCLE II

The poet often witnesses an event and then takes the reader to view the event as though he were watching it through the poet's eyes. This poem helps you to observe a fairly commonplace event, but the last six lines shift away from what you see to what the author feels.

SONIC BOOM by John Updike

I'm sitting in the living room.
When, up above, the Thump of Doom
Resounds. Relax. It's sonic boom.

The ceiling shudders at the clap,
The mirrors tilt, the rafters snap,
And Baby wakens from his nap.

"Hush, babe. Some pilot we equip,
Giving the speed of sound the slip,
Has cracked the air like a penny whip."

Our world is far from frightening, I
No longer strain to read the sky
Where moving fingers (jet planes) fly.
Our world seems much too tame to die.

And if it does, with one more pop,
I shan't look up to see it drop.

INTERPRETATION

1. How would you describe the state of mind of the author?
2. Why is he so relaxed, so fearless?
3. What effect do words like "boom," "clap," "whip," and "snap" have?
4. How do the first nine lines differ from the last six?
5. Why does he, at first, refer to sonic boom as the "Thump of Doom?"
6. Why does our world seem "much too tame to die?"
7. How do you feel about the couplet with which Updike ends the poem?

ENGLISH 251 SUPPLEMENTARY READINGS (NUMBER 4)

VOYAGE TO THE MOON by Archibald MacLeish

Presence among us

  Wanderer in our skies,
dazzle of silver in our leaves and on our
waters silver,
            O
silver evasion in our farthest thought -
"the visiting moon" ... "the glimpses of the moon" ...
and we have touched you!

   From the first of time,
before the first of time, before the
first men tasted time, we thought of you.
You were a wonder to us unattainable,
a longing past the reach of longing,
a light beyond our light, our lives - perhaps
a meaning to us ...
            Now
our hands have touched you in your depth of night.
Three days and three nights we journeyed,
steered by the farthest stars, climbed outward,
crossed the invisible tide - rip where the floating dust
falls one way or the other in the void between,
followed that other down, encountered
cold, faced death - unfathomable emptiness ...
Then, the fourth day evening, we descended,
made fast, set foot at dawn upon your beaches,
sifted between our fingers your cold sand.
We stand here in the dusk, the cold, the silence ...
and here, as at the first of time, we lift our heads.
Over us, more beautiful than the moon, a
moon, a wonder to us, unattainable,
a longing past the reach of longing,
a light beyond our light, our lives - perhaps
a meaning to us ...
            O, a meaning!
over us on these silent beaches the bright
earth,
            presence among us.

AUGUST MARTIN

THE USE OF THE AEROSPACE THEME IN SOCIAL STUDIES

SOCIAL STUDIES DEPARTMENT

The Social Studies Program Course of Study for Air Age And Related Subjects

Geography and Aviation
History of Flight
Aviation History
Aviation and Space Careers
Social, Economic and Political Impact of Flight
Aerodynamics Development
Military Aviation
Aviation Categories
Rocketry and Space Exploration
Lighter-than-air Flight

The Social Studies Program

The prime objective of the Social Studies Department is to teach Social Studies. However, there are motivational devices one can use to kindle the flame of knowledge and get the students' attention. August Martin High School has adopted an aerospace thematic approach to achieve this objective.

As a means of orienting all incoming students, a special one-cycle (ten weeks) course in the Air Age is made mandatory for all ninth-year students. The course spans the areas from myths and legends to the present-day rocket age. In addition to the history of aviation, the pupils are made aware of the social, political and economic impact of aviation.

In other areas throughout the four years at our school, every effort is taken to integrate aviation-oriented materials into the regular curriculum. In the study of geography, one not only deals with longitude and latitude, but with great circle routes. Students are made to realize that while on a plane surface a straight line is the shortest distance between two points whereas on a sphere an arc is the most direct way of getting from one place to another.

Every effort is made to stress and emphasize materials that lend themselves to our aerospace theme by discussing the great artists of the Renaissance. Copies of Da Vinci's aeronautical drawings are presented and discussed. From the Eighteenth Century on, there is a wealth of material that can be introduced to stimulate students' interest. In addition to the early experiments in lighter-than-air flight, the discussion of the use of balloons in the United States Civil War and the Franco-Prussian War give students insight into the fact that aircraft have been around and used for a long time.

Teachers in the Social Studies Department avail themselves of every opportunity to try and present interesting and informative materials that blend in with the school's aerospace theme. This approach not only adds interest to the course of study but, carried out over a four-year period and through all disciplines, generates enthusiasm and curiosity on the part of the student.

Sample Units in Social Studies

GEOGRAPHY AND AVIATION

I. Geography Related to Aviation

Objectives:

1. To review and reinforce basic skills in map reading.
2. To gather information through the use of graphs and charts.
3. To be able to attain information from cartoons and pictures.
4. To be able to listen and comprehend.
5. To be able to make generalizations based on information.
6. To be able to draw conclusions from maps, charts, graphs and reading selections.
7. To evaluate the material presented.
8. To develop an understanding of how the following are related to flight:
    - a. topography
    - b. climate
    - c. weather
    - d. time zones
    - e. the great circle
    - f. longitude and latitude
    - g. projection

II. Geography: Study of the Earth

1. Environment
2. Topography
3. How man affects his environment
4. How environment affects man

HISTORY OF FLIGHT

I. Introduction - Difference between Aerospace Training and Aerospace Education

A. Why study the history of aviation?

1. Man's roots in the past.
2. Study of man's "total environment."
3. Study of man's capability or ability to use the aerospace environment.
4. Man's ambitions and initiative.
5. Man has always wanted to improve environment; to do so he felt he must explore and use the resources of the aerospace environment.

II. Objectives

A. To develop an awareness of the inevitability of change as technology moves us ever faster should provide us with a degree of stability in the midst of revolution.

B. To explore man's desire to expand his knowledge and his control over material things within any given period of time.

C. To understand that with space exploration there is the imperative need for written agreements and laws between nations so that we can forestall the conflagration that could result.

D. To instill an appreciation for the courage of the explorers and pioneers of the past and present.

E. To develop an understanding of the present from a look at the past.

III. Folklore, Legends and Mythology about Flight
Green, Roman, Chinese, Northern European, African

A. Man's need to fly (explored)

1. The Myth of Phaeton
    a. How the sun moves across the sky
    b. Why it once stood still

2. Daedalus and Icarus
    a. Another journey through the sky

3. Hermes - Mercury
    a. Winged messenger of the Gods

4. Pegasus
    a. The winged horse

5. Emperor Shun

6. Ki Kung Shi

7. Lei Kung

8. Kites
    a. Discuss aerodynamics

9. Hammer of Thor (Northern Europe)

10. The Man Who Owned the Moon (Africa)
    a. Why there are dark spots on the moon

11. Magic Carpet (Arabic)

12. Judeo/Christian
    a. Elyah's chariot
    b. Winged angels

LIGHTER-THAN-AIR FLIGHT

Objectives:

1. To understand the concept of lighter-than-air flight.
2. To explore the development of aerospace based on this theory.
3. To understand that practical application of one field of knowledge must sometimes be delayed until further discoveries are made.
4. To understand that secrecy about scientific principles sometimes develops the whole progress of mankind.

How did one idea lead to another? Use overhead and show pictures of each.

I. The Balloon Era (Dirigibles)

a. What is lighter-than-air flight?
b. How does it work?
c. By whom was it developed?

1. Francesco de Lana - 1670 - air gets thinner and weighs less as altitude increases.
2. Henry Cavendish - 1776 - experimented with the lightness of heated air.
3. Montgolfier - 1782 - hot air experiments.
4. Francois Pilatre de Rozier - 1783 - the first man to ascend in a balloon.
5. De Rozier and Marquis d'Arlandes - first free flight.
6. Charles and The Robert Brothers - 12/1783 - 2 man hydrogen balloon.
7. Jean Pierre Blanchard - 1785 - crossed the English

Channel.

8. M. Henri Giffurd - 1852 - mechanical power for a balloon or dirigible.
9. Charles Renard - 1884 - improved the electric power propulsion technique.
10. Baumgarten and Wolfert - 1879 - benzine fueled internal combustion engine to power dirigibles.
11. Count Ferdinand von Zeppelin - rigid dirigible.

MILITARY AVIATION

Objectives:

1. To observe how wars had been fought prior to World War I.
2. To compare how wars were fought prior to the advent of the airplane with post observation developments (WWI-WWII, Vietnam, Desert Storm).
3. To analyze why there is an imperative need for written agreements and laws among nations.
4. To determine whether the aerospace age has acted as a deterrent to another world war.
5. To learn if developments in aviation have changed the way wars were fought.
6. To determine whether the development of missiles acted as a deterrent to another major war.

AVIATION CATEGORIES

Objectives:

1. To differentiate between civil aviation and military.
2. To investigate the impact of aviation on mankind.
3. To determine whether aviation has been a blessing or a curse.
4. To investigate the need for government regulating aviation.
5. To explore safety in air travel.
6. To analyze the general airlines organization chart (to see how an airline is organized).

Aim:

What has been the impact of developments in civil aviation on mankind?

Lesson Motivation: How have developments in aviation made it a "small world?"

I. Civil aviation

  A. Two main categories

    1. General Aviation
    2. Civil Air Carriers - companies formed for the specific purpose of carrying passengers, cargo, or both.

  B. Several types of flying

    1. Pleasure flying
    2. Business flying
    3. Commercial flying

II. The Air Transportation Industry (pictures of their planes)

A.	Convair 600	C.	Boeing 747
B.	Boeing 727	D.	SST (in the news)

III. How the airlines are organized.

IV. Regulation of Civil Aviation Traffic

  A. 1958 - Federal Aviation Agency regulates:

    1. Airways
    2. Airports

V. Problems created by the development of aviation

VI. Benefits reaped from the development in aviation.

SOCIAL, ECONOMIC AND POLITICAL IMPACT OF FLIGHT

Objectives:

1. To determine how all explorations of each age have changed man's social relationships.
2. To evaluate economic policies of the past with economic policies of the space age.
3. To understand that social and economic changes require governmental adaptations.

I. Exploration and Social Adjustment

  A. Why man explored the unknown.

    1. Curiosity
    2. Dissatisfaction with current status
    3. "Necessity the mother of invention"
    4. Power
      a. Hittites
      b. Helenes
      c. Tartars

    - d. Romans
    - e. Moslems
    - f. Spanish
    - g. French
    - h. English
    - i. Napoleon
    - j. Hitler
    - k. American

B. Factors that stimulated exploration

1. Resources
2. Type of resources allocated toward this goal
3. Technology limits or enhances expansion
    - a. Vehicle available
    - b. Navigation systems
    - c. Ability to cope with the environment
    - d. Satisfying needs and wants

C. Results of expansion

1. Conflict
2. Laws
3. Technology
4. Impact on the culture of the society

II. Space Exploration

A. Difference between space exploration and all other explorations
B. Financing space exploration
C. National goals
D. New technology involved
E. Effect on education

III. Economic Policies of one age do not meet needs of a "New Age."

A. Effect of new transportation and communication on economic policy.

1. New World lack of fast communication - development of self-sufficiency and independence.
2. Civil War - demise of an economic system in the South that failed to keep up with technology.
3. 19th - early 20th Century - "laissez faire" suffered with telegraph lines and railroads. Interdependence of one area upon another realized.
4. Mid 20th century - space reinforces interdependence among nations.

IV. Social and Economic Changes Necessitated Governmental Adaptations

A. Will basic unit of civilization be threatened by the increasing mobility of the air age?
B. Will Space Age affect our concept of "private property," and "national property?"
C. Why does the size of a governmental unit increase its complexity?
D. What happens to the individuality of the human being in a mechanical world?
E. Will educational practices of today need to be changed to meet the exigencies of tomorrow?
F. How would joint space explorations by major powers be financed?
G. Problems of international cooperation with regard to projected uses of the moon.

AVIATION AND SPACE CAREERS

The course will include:

Films - Age of Man - Was Anything Done?

In Search of Lost Persons
Future Shock
Aeronautical Oddities
To Fly

Filmstrips

Myths and Legends
History of Flight
Careers in Aviation

Visual Aids

Pictures of balloons, airplanes, etc.
Reading selections - short stories - poems
Guest speakers: careers in aviation - weather affects aviation - storm fields

Audio Aids

Records - songs on flying - Example: 2001, Space Age, War of the Worlds

BEST COPY AVAILABLE

Course Requirements:

1. History of flight (12 homeworks)
2. Book reports
3. Oral Report on a project - describe and illustrate
4. Term paper - organizing, researching, writing

THE USE OF THE AEROSPACE THEME IN MATHEMATICS

MATHEMATICS DEPARTMENT

The Mathematics Department Program Thematic Aviation Applications

Arithmetic Drill Tenth-Year Mathematics

Mathematics Department Program

Mathematics education has come under much criticism for not being application-oriented. It has been claimed that abstractions have not provided meaningful educational experiences for students and often resulted in low interest. To increase motivation for mathematics learning, aerospace has been introduced as thematic material. The wealth of information available and its possibilities for application at all levels of mathematics education make it a well-spring of motivational sources.

At August Martin High School, some of the areas of algebra that use aerospace applications include:

> Arithmetic drill, signed numbers, space, algebraic expressions, operations with signed numbers, verbal problems, functions, ratio and percent, Pythagorean theorem, proportions, similar triangles, trigonometry, literal equations, scientific notations, conic sections, evaluating formulas and logarithms.

Aerospace applications in geometry at August Martin High School are included in the following topics:

> Angle measure, congruent triangles, alternate-interior angles of parallel lines, similar figures, Pythagorean theorem, trigonometry, angle of elevation, angle of depression, longitude and latitude, circumference of circle, area of circle, length of arc, area of rectangle, square, equilateral triangle, regular hexagon, circle, zone, sphere, cylinder and volume of rectangular solid, sphere and cylinder.

Thematic Aviation Application

ARITHMETIC DRILL

1. A certain airline bases its fares for tickets at the rate of 13¢ an air mile. Find the cost from New York to each of the following cities: a) Boston (188 miles); b) Atlanta (748 miles); c) Dallas (1374 miles); d) Los Angeles (2451 miles); 3) Moscow (4860 miles).

2. In 1889, Nellie Bly flew from New York around the world. The trip took 72 days, 6 hours and 11 minutes. Find the number of minutes in the entire trip.

3. Major Robert M. White, of the United States Air Force, holds the world record for altitude in an aircraft. On July 17, 1962, he left Edwards Air Force Base, California, flying a North American X-15-1 and reached an altitude of 314,750 feet.

a) What was his altitude to the nearest tenth of a mile? (Note: there are 5,280 feet in a mile).

b) What was his altitude to the nearest hundredth of a rod? (Note: there are 320 rods in a mile).

The following table is to be used in answering problems 4-8.

Following is a table listing several bodies in space, the number of days each body takes to revolve about the sun, the surface gravity factor by which earth weight is multiplied to find weight on that body, and the average distance from the sun, in miles.

BODY	PERIOD OF REVOLUTION	SURFACE GRAVITY	AVERAGE DISTANCE FROM SUN (miles)
Earth	365 days	1.00	93,000,000
Jupiter	11.9 years	2.64	483,000,000
Mars	1.88 years	.39	141,500,000
Mercury	88 days	.26	36,000,000
Moon	27 1/3 days	.17	-
Neptune	165 days	1.12	2,793,000,000
Pluto	248 days	Unknown	3,670,000,000
Saturn	29.5 years	1.07	886,000,000
Sun	-	28.00	-
Uranus	84 years	.91	1,782,000,000
Venus	225 days	.86	67,000,000

4. Using the preceding table, complete the following table by finding the number of hours it takes for one complete revolution about the sun for each of the listed bodies:

BODY	PERIOD OF REVOLUTION (in hours)
Earth	
Mercury	
Moon	
Neptune	
Pluto	
Venus	

5. Using the table above, complete the following table by finding the number of days it takes for one complete revolution about the sun for each of the listed bodies:

BODY	PERIOD OF REVOLUTION (in days)
Jupiter	
Mars	
Saturn	
Uranus	

6. Find your weight on each of the listed bodies whose surface gravity factor is given.

7. Below are listed the weights of several individuals as measured on different bodies in space. Using the table, complete the table below by finding their weights on earth:

NAME	BODY	WEIGHT OF BODY	WEIGHT ON EARTH
Richie Allen	Jupiter	501.6 lbs.	
Willis Reed	Mars	93.6 lbs.	
Mohammed Ali	Mercury	57.2 lbs.	
Ken Harrelson	Moon	25.5 lbs.	
Wilt Chamberlain	Neptune	291.2 lbs.	
Sherman Plunkett	Uranus	300.3 lbs.	
Dave Debusschere	Saturn	240.75 lbs.	
Tommy Agee	Sun	5,600 lbs.	
Frank Howard	Moon	47.6 lbs.	
Walt Frazier	Uranus	185.55 lbs.	
Joe Namath	Venus	172 lbs.	
Roy White	Jupiter	422.4 lbs.	

8. If light travels at the rate of 186,000 miles per second, find, to the nearest second, the length of time it takes for light to travel from the sun to each of the bodies listed in the table in Item 7.

SIGNED NUMBERS

9. Explain the meaning of "NASA Control" using the numbers "minus ten, minus nine, minus eight, minus seven, minus six, minus five, minus four, minus three, minus two, minus one, lift-off."

10. Consider a vertical lift-off of a spaceship:

a. Set up a number line to represent its height at any time following lift-off.

b. Choose a point on the number line to represent zero.

c. Assign directions to the number line.

d. Find the coordinate associated with a height of 4,392 feet.

e. Interpret the meaning of negative numbers on the number line.

f. What, if any, should be the limits on the positive and negative directions on the number line? (Note: the diameter of the earth is approximately 7,900 miles.)

ALGEBRAIC EXPRESSIONS

11. The speed of sound at sea level and a temperature of 59 degrees Fahrenheit is 760.0 miles per hour.

a. If the rate of speed of a plane, in miles per hour, is indicated by the variable R, what is the domain of R if the fastest rate of the plane is the speed of sound?

b. If the letter s is used to represent the speed of sound at sea level and a temperature of 59 degrees Fahrenheit, is s a variable or a constant?

12. If RT represents the distance covered by a plane flying at R miles per hour for T hours, find the distance covered by a plane whose rate is 650 mph, in 4 hours.

13. How many seats are there in a plane containing n rows with 6 seats in each row?

14. If a plane is flying at an elevation of 10,000 feet and the pilot begins to increase the elevation of the plane at the rate of f feet per second, what will the elevation of the plane be after 20 seconds?

15. The number of "g's" pulling a body refers to the number of times the force of gravity is pulling on a body. The weight of a body is equal to the number of g's pulling on it multiplied by the "normal" weight of the body under 1g.

a. Write a formula relating the weight of a body, W, under N g's to the weight of the body, w, under 1g.

b. In the first two minutes from the launching of John Glenn's "Friendship 7" Mercury spaceship the force of gravity built up to 6.7 g's. If John Glenn's weight on the ground had been 170 pounds, what was his weight under 6.7 g's? (Answer to the nearest pound.)

ADDITION OF SIGNED NUMBERS

16. A ticket agent at Martin Airlines was given a list of 114 reservations for a group flight to Nigeria and then was notified of 27 cancellations. How many reservations remained on the list? (Use signed numbers.)

17. A weather balloon was testing air turbulence while being controlled by an operator on the ground. The balloon was originally flying at an altitude of 7,000 feet. The operator, wishing to test the turbulence at different altitudes, first raised the balloon 4,000 feet, then lowered it 6,000 feet, then raised it 9,000 feet. What was the altitude of the balloon after these three changes in elevation?

MULTIPLICATION OF SIGNED NUMBERS

18. If an airline ticket office had 3 cancellations a day for one week what was the relationship between the number of reservations it had at the end of the week and the number of reservations it had at the beginning of the week? (Use signed numbers in answering this question.)

SUBTRACTION OF SIGNED NUMBERS

19. How much time has elapsed between "lift-off - 10" and "lift-off +10?"

20. What is the difference between a plane flying at 25,000 feet altitude and a helicopter flying at 200 feet altitude?

VERBAL PROBLEMS

21. A plane is flying into the wind. If the plane's velocity is 300 m.p.h. more than the wind velocity and the difference between the plane and wind velocity is 250 m.p.h., find the wind velocity.

22. The wingspan of a plane is 10 feet more than the length of the plane. The sum of the wingspan and the length of the plane is 130 feet. Find the length of the plane.

FUNCTIONS

23. In air travel Mach 1 represents the speed of sound, Mach 2 represents twice the speed of sound, Mach 3 represents thrice the speed of sound, etc. A vehicle is said to be flying at subsonic speed if its velocity is less than Mach 0.75, transonic speed if its velocity is between Mach 0.75 and Mach 1.2, supersonic speed if its velocity is between Mach 1.2 and Mach 5.0, and hypersonic speed if its velocity is greater than Mach 5.0:

a. Represent this information as a function of velocity f(v).

b. What is the domain of this function?

c. What is the range of this function?

d. According to the definition, what are the values of f(.75), f(1.2), f(5.0)?

e. How can this definition be improved?

24. Two airplanes start from the same airport at the same time and travel in opposite directions. One airplane travels at 300 m.p.h. and the other airplane travels at 350 m.p.h.

a. Express the distance between the two airplanes as a function of time.

b. What is the domain of this function?

c. What is the range of this function?

ANGLE PROBLEMS

25. If wind direction is considered to be horizontal the angle of attack of an aircraft is the angle between its airfoil (such as its wing) and the wind direction. If this angle is too great the aircraft will not be able to fly. This angle, called the critical angle of attack (or burble point) causes turbulent flow of air and will produce no lift. If the burble point of an airfoil is 42 degrees which is 4 more than twice the angle of attack, what is the angle of attack?

26. A spacecraft is being prepared for launching. Maintenance men, making last-minute check-ups on the vehicle have placed a long ladder from the ground up against the craft. The angle between the ladder and the spacecraft is 6 degrees less than 5 times the angle between the ladder and the ground and the angles are complimentary. Find both angles.

UNIFORM MOTION PROBLEMS

27. Two aircraft flying in opposite directions pass each other in flight. If the first aircraft was flying at 350 m.p.h. and the second was flying at 500 m.p.h. in how many hours will they be 3,400 miles apart?

28. Two aircraft are flying in the same direction. The faster plane passes the slower plane at 1400 hours. If the faster plane were flying at 500 m.p.h. and the slower plane was flying at 350 m.p.h., at what time will the planes be 375 miles apart?

MIXTURE PROBLEMS

29. A pilot has his plane filled with fuel from two different pumps. In one pump the price of fuel was 35¢ a gallon and in the second pump the price of fuel was 40¢ a gallon. If his total bill was $13.05 for which he received a total of 34 gallons of fuel, how many gallons of each type of fuel did he receive?

30. The radiator of an airport passenger bus contains 32 quarts of a mixture which is 80% water and 20% alcohol. How much pure alcohol must be added to produce a mixture that is 30% alcohol?

AREA PROBLEMS

31. The length of a rectangular runway is 940 feet more than its width. It is discovered that the area of the runway would be the same if the width was decreased by 20 feet and the length was increased by 500 feet. Find the original dimensions of the runway.

WORD PROBLEMS

32. A man can send 100 coded messages in a day. A machine can send 700 coded messages a day. How long would it take both working together to send 1,400 messages?

VERBAL PROBLEMS INVOLVING QUADRATIC EQUATIONS

33. The length of one rectangular glider of a biplane is 35 feet more than its width and the area of the glider is 200 square feet. Find the dimensions of the glider.

34. A man in freefall will cover a distance, d, according to the formula $d=16t^2$, where t represents the time, in seconds, he is falling. How long will it take a man to fall 256 feet?

35. An airplane flew a distance of 600 miles. On its return trip its speed was increased by 40 m.p.h. The return flight took 30 minutes less than the original flight. Find the original speed.

RATIO AND PERCENT

36. Air is made up of many gases according to the following composition (rounded off to the given accuracy): 78.0% nitrogen, 20.94% oxygen, 0.94% argon, 0.03% carbon dioxide, 0.03% hydrogen, 0.0012% neon and 0.0004% helium. Find the amount of each of its constituent gases in 500 cubic feet of air. (Answer to the nearest hundredth of a cubic foot.)

37. The ratio of fuel to air is the most important single factor in determining the power output of an engine. This ratio is controlled by the pilot. If there are 17 parts of air to 1 part of gasoline, by weight:

a. Find the fuel-to-air ratio.

b. Find the percent of air in the mixture. (Answer to the nearest tenth of a percent).

c. In 120 pounds of mixture, find the number of pounds of fuel. (Answer to the nearest tenth of a pound.)

38. The federal excise tax on domestic flight is 8%. Find the total cost of a domestic flight where the cost of the ticket is $135.00.

INTEREST PROBLEMS

39. In order to raise money to purchase a private plane a man had to borrow $6,300. He was able to obtain one loan from a bank charging 6% interest. He obtained the balance of the money from a bank charging 7 1/2% interest. The total amount of interest paid was the same in each bank.

a. How much money did he borrow from each bank?

b. What was the amount of interest paid to each bank?

VERBAL PROBLEMS INVOLVING TWO VARIABLES

40. In order to profitably run a particular flight an airline calculated it would have to receive $9,900 in fares. However, passengers complained that the plane was too crowded. The airline discovered it could still receive the $9,900 for the flight while reducing the number of passengers it carried by 10, if it raised its fare by $9. Find the original number of passengers it carried and the original fare.

41. An airplane flew back and forth between two cities that are 2,400 miles apart. It took 6 hours on the initial flight flying against the wind and 4 hours and 54 minutes on the return flight flying with the wind. Find the rate of the plane in still air and the rate of the wind.

PYTHAGOREAN THEOREM

42. An airplane is on a flight from city A to city C with a stopover in city B. The distance from A to B is 80 miles and the distance from B to C is 150 miles. If the paths between A and B, and B and C are at right angles, find the distance the airplane would cover on a direct flight from A to C.

PROPORTIONS

43. If 7 airplane flight tickets cost $784.98, find the cost of 9 tickets.

SIMILAR TRIANGLES

44. If a vertical rocket 150 feet in height casts a shadow of 40 feet, how high is a nearby building that casts a shadow of 15 feet?

TRIGONOMETRY PROBLEMS

45. Find the height of a flight control tower if the angle of elevation from a point 50 feet from its base to the top of the tower is 65 degrees.

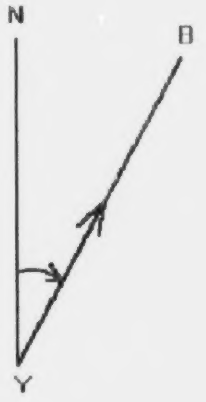
46. An airplane is flying low over the ocean at an elevation of 3,000 feet. Find the angle of depression from the airplane to a ship at sea that is 500 feet away from a point directly below the airplane.

EVALUATING FORMULAS

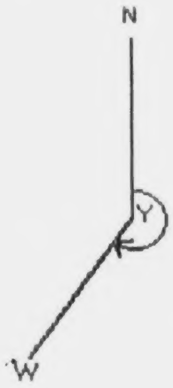
47. The formula for changing from degrees on the Centigrade scale to degrees on the Fahrenheit scale is C=5/9 (F-32), where F is the temperature in degrees Fahrenheit, and C is the temperature in degrees Centigrade. The temperature on the surface of the planet Mercury on the side facing the sun is believed to be about 430 degrees Centigrade. Express this temperature on the Fahrenehit scale (to the nearest 10 degrees).

TENTH YEAR MATHEMATICS

1. A pilot flying from New York to Boston must follow the direction represented by ray $\overrightarrow{YB}$. The clockwise angle NYB, between a true north ray from New York and the direction of flight, is called the course of the plane. Find the angle measure of this angle with a protractor to determine the course the pilot would follow.



2. A pilot flying from New York to Washington would follow the direction represented by ray $\overrightarrow{YW}$. The clockwise angle NYW, as indicated in the diagram, would be the course the plane would follow. Use a protractor to determine his course.



The magnetic compass is used to show the direction of flight. There are 360 degrees in the compass circle. North is 0 degrees. East is 90 degrees. South is 180 degrees. West is 270 degrees. Express the following directions in degrees of the compass:

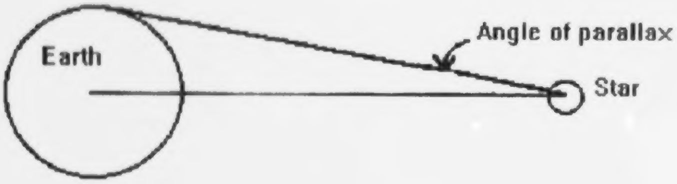
3. Northeast
4. Southeast
5. Southwest
6. Northwest

Magnetic forces in the earth and in each aircraft affect the magnetic compass. The difference between true north and magnetic north is called variation. Compass error caused by magnetic forces in the aircraft itself is known as deviation. If, for example, a pilot desires to fly a true course of 90 degrees in an area where the variation is +10 degrees and his compass variation is -5 degrees, he must fly a compass heading of 95 degrees to achieve his true course, since 90 + 10 - 5 = 95. Determine the magnetic and compass headings for each of the following flights:

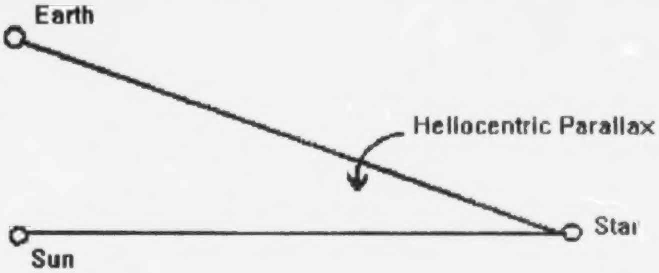
	True Course	Variation	Magnetic Heading	Deviation	Compass Heading
7.	082 deg	-4 degrees		+2 degrees	
8.	274 deg	+9 degrees		-5 degrees	
9.	350 deg	+7 degrees		-4 degrees	

CONGRUENT TRIANGLES

An angle of parallax is the change in direction when a star is viewed from two different points. It may be the angle subtended at the star by the radius of Earth.



For distant stars a heliocentric parallax is used. This is an angle formed by rays from the Sun and Earth.

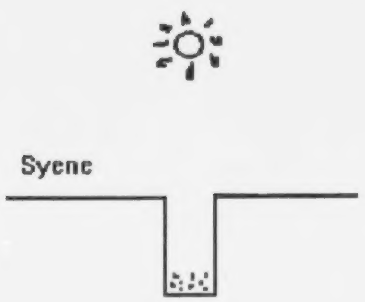


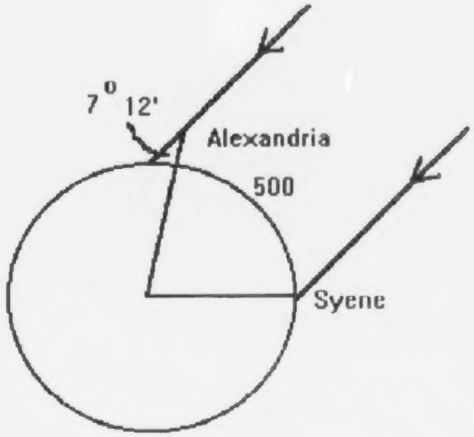
10. If the heliocentric parallax of a star is 2 degrees on September 1, what will it be on March 1, six month's later? Assume the orbit of Earth about the Sun is circular.

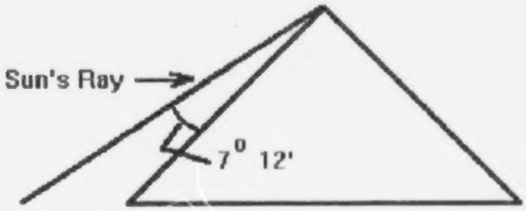
ALTERNATE-INTERIOR ANGLES OF PARALLEL LINES

Many people claim that Columbus proved that Earth is round. However, a Greek scholar, Eratosthenes, who lived about 200 B.C., which is almost 1700 years before Columbus, did more than that. He found the approximate circumference of Earth.

Eratosthenes first selected two places in Egypt to gather his information. One of these places was a well in Syene (now the city of Aswan). The other place was a pyramid in Alexandria. The well in Syene and the pyramid in Alexandria were approximately 500 miles apart. He waited until a certain day of the year when he knew the Sun was directly overhead because he could see its reflection on the bottom of the well. On that same day an observer in Alexandria noted the shadow cast by the pyramid and measured the angle formed by the Sun's ray and the pyramid as approximately 7 degrees 12 feet.



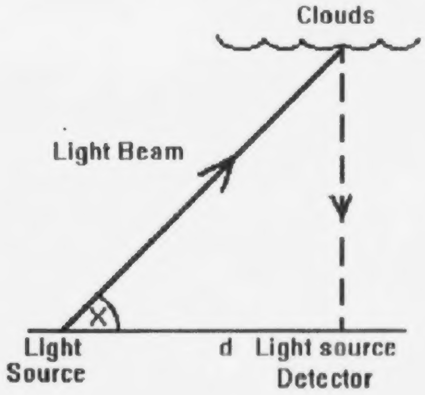

7° 12'
Alexandria
500
Syene


Sun's Ray
7° 12'

11. Assuming the rays of the Sun are parallel, what was Eratosthenes' measure of the circumference of Earth.

TRIGONOMETRY

A sweeping light beam is used with a light source detector to determine the height of clouds directly above the detector, as illustrated in the diagram.


Clouds
Light Beam
x
Light Source
d
Light source Detector

The light beam sweeps from the horizontal (angle x = 0 degrees) to the vertical (angle x = 90 degrees). When the beam illuminates the base of the clouds directly above the detector, the angle x is read, and with d, the distance between the light source and the light source detector, known, the height of the clouds can be computed.

12. If the light source is 1,000 feet from the light source detector and the light beam is reflected from clouds when angle x = 63 degrees, find the height of the clouds.

13. Find angle x if the clouds are 1,200 feet high and the light source is 900 feet from the light source detector.

At many United States National Weather Service stations two light sources are used to gain more reliable data. One light source is 800 feet from the detector and the other light source is 1,600 feet from the detector.

14. If the angle at the 800-foot light source is 51 degrees when a cloud is 1,000 feet high, what is the angle at the 1,600-foot source?

THE USE OF THE AEROSPACE THEME IN FOREIGN LANGUAGES

FOREIGN LANGUAGES DEPARTMENT

Foreign Language Program   Samples of Foreign Language Materials

FOREIGN LANGUAGE PROGRAM

The supersonic jet and swifter forms of worldwide communications have contracted the globe; consequently the need to communicate with our neighbors abroad has become all the more imperative. our international relations are constantly expanding as we endeavor to build and maintain alliances for securing the peace, to provide technicians and material assistance to underdeveloped countries, to engage in international cooperation in science, technology and business and to promote large-scale cultural exchanges of students, teachers, artists, musicians and leaders in many fields. The importance of acquiring a working knowledge of foreign languages is constantly increasing as our far-flung activities and our destiny grow more and more intertwined with those of other peoples.

In foreign languages, each student is permitted to work at his own pace. After a first "common cycle," students are screened and placed into one of the three separate tracks: A "fast" track where students will be able to cover the year's work in three cycles; an "average" track where four cycles will be needed; and a "slower moving, more conversational" track where students will cover the year's work in six cycles. The rewards of such an arrangement are apparent. There is no failure attitude but rather a moving forward constantly at the student's own rate of speed. Success is guaranteed!

The use of modular scheduling techniques in class programming will provide the time flexibility for a wider variety of instructional approaches; the teachers and students will be able to engage in skits and dialogue routines and variations; there will be greater time available for the use of the language laboratory; and visual aids will become an integral part of classroom activities.

In all foreign language classes at August Martin High School, the students have the opportunity to engage in off-campus laboratory work at airport facilities and will be additionally rewarded via field trips to the world's largest airport where the languages they are studying will "come alive" as the youngsters hear and speak with the many people who speak the very languages the Martinites are learning.

PERSONAL INTERESTS

1. Vocational

In a world where travel by jet plane is a reality, the demand for men and women with training in a foreign language is ever increasing. There is a growing need for government employees, diplomatic and consular representatives, and industrial personnel who are bilingual or who have a working knowledge of two or more languages. American-trained skilled workers with a good foreign language background are always sought by companies involved in business and industrial enterprises in foreign languages. There is a need for engineers, scientists, teachers, bankers, military men, and businessmen who can travel and live abroad. To make them more effective in their work, a knowledge of foreign languages is essential. There is every indication, therefore, that opportunities for employment are greater and more varied for the individual who has mastered a language other than his own. Some fields in which a knowledge of foreign languages is advantageous are:

Diplomatic Service
Aerospace Medical Technology
Careers on Operatic and Concert Stage
Import and Export Trade
Passenger Servicing
Foreign Banking
Newspaper and Magazine Editing

Museum Work
Flight Attendant
Teaching of Foreign Languages
Scientific Research
Avionics
Publishing
Library Science
Airport Vehicle Technician
Travel and Tourist Agencies
Intelligence and Security Agencies
Translating and Interpreting
Bilingual Stenography
Radio Broadcasting
Employment at the United Nations Headquarters or Specialized Agencies

2. Avocational

Even when the study of foreign languages is not a requirement for a specific career or job, the ability to understand and speak it may be an asset to any individual. Many personal interests and leisure time pursuits are associated with an appreciation of the language, life and customs of the people whose language is studied. Some avocational activities involving a knowledge of a foreign language are:

- travel
- speaking the language of the country visited makes the trip more worthwhile
- reading literature in its original form
- enjoyment of foreign language films, plays, opera, etc.
- listening to foreign language broadcasts
- communicating with visitors from foreign lands
- engaging in "Pen Pal" correspondence

AIMS OF FOREIGN LANGUAGE INSTRUCTION

General Aims

The general aim of instruction in foreign languages is to develop in pupils the skills needed for effective communication in the foreign language. A concomitant aim is to develop in pupils an understanding of the foreign people, of their country and of their culture.

Linguistic Aims

To understand the foreign language when spoken by a native at normal tempo and on a topic within the pupil's experience. To speak the foreign language on topics within the pupil's experience with sufficient clarity to be understood by a native. To read with direct comprehension material within the pupil's experience. To write in the foreign language on topics within the pupil's experience.

Cultural Aims

To develop an enlightened understanding of the foreign people through a study of their contemporary life, their patterns of behavior and their national customs and observances. To acquire specific knowledge regarding the geography, history, economic life and educational and political institutions of the foreign people. To acquire attitudes conducive to intercultural harmony through a study of the contributions of the foreign people to the development of the United States and of world civilization. To develop cultural and esthetic appreciations through a study of the foreign country's art, music, literature, science and contemporary art forms, such as drama, film, dance and design. To promote growth in the language arts through the development of language consciousness.

SAMPLES OF FOREIGN LANGUAGE MATERIALS

Viaje en avión

El avión es un medio rápido de transportación aérea en nuestros días. Los aviones cruzan los cielos, a grandes alturas, para ir de una nación a otra en el mundo, en pocas horas.

Casi todas las naciones del mundo poseen sus propios aviones nacionales; unos van de ciudad a ciudad, y otros se dirigen hacia naciones extranjeras. En todas las capitales de las naciones existen modernos aeropuertos donde aterrizan aviones procedentes de todos los países. Hoy podemos ir a cualquier nación del mundo en muy pocas horas.

Los aviones, en nuestros días, llevan equipos y sistemas modernos de control que les permiten despegar y aterrizar con mucha facilidad. Los panele de control de los aviones están equipados con sistemas de radar y de computadores. Con ellos los pilotos están en communicación constante con las torres de control de los aeropuertos; conocen la altura a que va el avión, la velocidad y la ruta marcada para el vuelo.

Los aviones de largas distancias llevan ordinariamente cuatro potentes motores reactores. Son aviones grandes que pueden transportar un gran número de pasageros.

La tripulación de los aviones son personas muy bien preparadas. Los pilotos reciben un largo entrenamiento, a veces de muchos años. Muchos de ellos han sido pilotos de aviones de guerra con una larga experiencia.

Las azafatas explican a los pasajeros cómo usar los equipos de emergencia. Por si fuera poco todo pasajero puede leer en una cartulina lo que debe hacer en un caso de emergencia.

Los asientos de los aviones son reclinables para poder dormir durante el vuelo. A horas determinadas, las azafatas sirven comidas y bebidas a los pasajeros; ellas están pendientes de otras necesidades de los pasajeros. El pasajero puede incluso afeitarse con maquinilla eléctrica en los baños, tan limpios y tan higiénicos. En muchos de los aviones de larga distancia el pasajero puede oir música, ver una película o pedir una revista para leer.

En nuestros días es muy fácil conseguir un boleto para un viaje en avión. Todas las compañías de aviación tienen oficinas en las ciudades; Ud. puede ir personalmente a la oficina; puede además reservar el boleto con muchos días de anticipación. Es muy fácil también conseguir los boletos de viaje por medio de otras agencias de viajes.

El pasajero debe estar en el aeropuerto una hora antes de la salida del avión. En el aeropuerto le recibirán las maletas, y le entregarán un comprobante. Las maletas van en el mismo avión, aunque en compartimiento distinto. El pasajero puede llevar consigo una pequeña maleta de mano o un bulto. Si lleva un peso mayor del fijado tendrá que pagar un sobrepeso. En las compañías hispanoamericanas el peso de las maletas es de 20 kilos aproximadamente.

Al llegar al lugar de destino, el pasajero recogerá su maleta en el departamento de equipajes. Ya hay señales de dirección en todos los aeropuertos que le llevan hasta donde el pasajero encontrará su maleta. Estas vienen por correderas movibles y Ud. puede identificar la suya mediante el número de comprobante que lleval fijo en su boleto.

En todos los aeropuertos el pasajero tiene facilidades de transportación hasta el centro de la ciudad. Puede elegir entre taxis, autobuses, o transportación facilitada por la misma compañia de aviación.

Hoy, el viajar en avión es rápido, fácil, cómodo y sobre todo es seguro.

aterrizar	to land	despegar	to take off

AUGUST MARTIN

tripulación f personas que van en un avión o en barco, dedicadas a su servicio y maniobra

Preguntas sobre la lectura. Escriba la respuesta.

1. El avión, ¿es el medio rápido de transportación terrestre?

2. ¿Adónde van los aviones cruzando los cielos?

3. ¿Qué poseen casi todas las naciones del mundo?

4. ¿Adónde van unos y adónde van otros?

5. ¿Qué existe en casi todas las capitales del mundo?

6. ¿Adónde podemos ir, hoy diá, en avión?

7. Los aviones, en nuestros días, ¿qué llevan?

8. ¿Con qué están equipados los paneles de control?

9. ¿Para qué les sirve a los pilotos el radar y los sistemas de computadores do los aviones?

10. ¿Cómo son ordinariamente los aviones de largas distancias?

11. Los pilotos, ¿reciben un corto entrenamiento?

12. ¿Qué les explican a los pasajeros las azafatas?

13. ¿Qué puede leer todo pasajero, en una cartulina?

14. ¿Qué sirven las azafatas, a horas determinadas?

15. ¿De qué están pendientes las azafatas?

16. ¿Qué puede oir, ver o pedir el pasajero?

17. Las compañías de aviación, ¿qué tienen en todas las ciudades?

18. ¿Puede el pasajero reservar su boleto con anticipación?

19. ¿Cómo puede conseguir también el boleto, el pasajero?

20. ¿A qué hora debe estar el pasajero en el aeropuerto?

21. ¿Qué le recogerán en el aeropuerto, al pasajero?

22. ¿Qué puede llevar consigo el pasajero?

23. ¿Cuántos kilos permiten las compañías de aviación?

24. ¿Dónde recogerá su maleta, el pasajero?

CONVERSACION 23

VOLANDO A ESPAÑA (PRIMERA PARTE: EN EL AEROPUERTO)

Al fin Domingo Ocasio va a hacer el viaje de sus sueños. Va a visitar a todos sus amigos y familiares en España. Hace mucho tiempo que no los ve. Ahora está de vacacciones y tiene la oportunidad. Va al aeropuerto Kennedy en Nueva York para comprar los billetes.

El señor Ocasio - Quisiera dos billetes de ida y vuelta a Madrid.

El dependiente - ¿Para qué día, señor?

Ocasio - Bueno, tengo que estar en España el próximo sábado, a más tardar.

Dependiente - Está bien. Tenemos un vuelo directo, con destino a Madrid, este viernes.

Ocasio - ¿A qué hora sale?

Dependiente - Sale a las nueve de la noche, y llega al aeropuerto Barajas a las nueve y media al día siguiente.

Ocasio - Perfecto. Necesito dos billetes. ¿Hay mucha diferencia en el precio entre el billete de primera clase y el de turista?

Dependiente - Claro, pero vale la pena si viaja con una persona importante.

Ocasio - Bueno, déme dos billetes de turista. Viajo con mi mujer.

VOLANDO A ESPAÑA (SEGUNDA PARTE: EN EL AVION)

La Azafata: Muy buenos días señoras y señores. Bienvenidos al vuelo 635 de Iberia. Su piloto es el Capitán Miranda. Volamos a velocidad de 1.000 (mil) kilómetros por hora. Delante de sus asientos hay una máscara de oxígeno en caso de emergencia. Durante el despegue, abróchense los cinturones de seguridad y favor de no fumar. Muchas gracias.

Seis horas más tarde ...

El señor Ocasio: Hace seis horas que estamos volando. ¿Cuándo vamos a aterrizar?

Señora de Ocasio: Siempre te quejas. Estos vuelos por avión a chorro son magníficos y la comida y el servicio excelentes.

El señor Ocasio (llanamdo a la azafata): Señorita, ¿cuánto va a durar este vuelo?

La azafata: Ya falta poco. No tardaremos más que media hora en llegar.

El señor Ocasio: Gracias a Dios. Antes de comenzar el descenso quiero tomar un refresco y algo que comer.

La azafata: Lo siento señor. Es demasiado tarde. Vd. estaba durmiendo durante la comida.

EXERCISES

I. Do you know the answers to these questions?

1. ¿Qué va a hacer el señor Ocasio?
2. ¿De dónde va a salir el avión?
3. ¿Qué clase de billete va a comprar el señor Ocasio?
4. ¿Cuándo sale el avión de Nueva York?
5. ¿Qué clase de vuelo es?
6. ¿Quién saluda a los pasajeros al entrar en el avión?
7. ¿Cómo se llama el piloto?
8. ¿A qué altura está volando el avión?
9. ¿Qué hay delante de los asientos?
10. Durante el despegue, ¿qué tienen que hacer los pasajeros?

II. Complete the statements with an appropriate word:

1. Este verano voy a hacer un ______________ a España.
2. Tengo la __________ de visitar a mis __________.

3. Voy al ___________ Kennedy en Nueva York para comprar dos ___________ de ida y veulta.

4. Bienvenidos al ___________ de Iberia.

5. Volamos a una altura de diez mil ___________.

6. En caso de emergencia, hay una ___________ de oxigeno.

7. Durante el ___________, es necesario abrocharse los ___________ de seguridad.

8. Los vuelos por ___________ a chorro son magníficos.

9. El avión va a comenzar el descenso, y va a ___________ en quince minutos.

10. Durante el descenso, la azafata les informa a los pasajeros que no se permite ___________.

THE USE OF THE AEROSPACE THEME IN SCIENCE

SCIENCE DEPARTMENT

The Science Program	**Sample Science Materials**
Biology	Principles of Flight

The Science Program

Science educators have long held the belief that they hold an advantage over their colleagues in other disciplines because students come to school with an innate interest in science. Youngsters grow up fascinated with the physiology of the human body, space travel, astronomy, life in the oceans and the planet Earth itself.

With this inherent pupil interest in mind, the science staff at August Martin High School was ecstatic with the thought of using aerospace as a motivational theme - a golden thread with which to link various topics in the science curriculum.

Our view of the motivational theme concept is that it is multifunctional in nature. It serves to:

1. Unify all subject areas within the school.
2. Relate subject matter to potential career opportunities.
3. Enrich the course of study.
4. Heighten pupil interest in education.

Our task was to first provide basic interdisciplinary instruction in aviation or aerospace technology early in the student's high school experience, preferably in the ninth year. This was accomplished through such mandatory courses as "Principles of Flight," "History of Aviation," "The Air Age" and "Aircraft Model Building."

Equipped with this basic knowledge the student, in subsequent grades, could be expected to relate the experiences of an aircraft pilot to a scientific principle. For example, the mechanical process of external respiration can be presented in the classroom within the framework of a pilot's physiology as his aircraft rises from sea level to an altitude of fifteen thousand feet.

How does a reduction in atmospheric pressure effect the process of breathing? How does atmospheric pressure at sea level compare with atmospheric pressure at high altitudes? Is sufficient oxygen available at high altitudes to carry out internal respiration? What is the role of oxygen in internal respiration? Can Dreb's Cycle possibly be affected by a deficient oxygen supply at high altitudes? How is blood pressure and pulse rate affected by high altitude flight? The answer to one question suggests another question.

Our overall appraisal of the use of aerospace as a motivational theme, wherever possible in science instruction, is that the excitement, glamour and magnetic appeal of this subject has grasped the imagination of the vast majority of our students and has enabled a substantial number to achieve a level of success in strictly academic subjects that had not previously been attained.

We heartily endorse and recommend its inclusion in high school programs.

Sample Science Materials

BIOLOGY

Lesson 1

AIM: Physiological Problems in Flight: Respiration

OUTCOMES: 1. As altitude increases the air becomes colder, thinner and lighter.

2. Atmospheric pressure decreases as altitude increases.

3. A partial reduction in the amount of available oxygen can cause serious illness.

MOTIVATION: Review the composition of air. (Nitrogen 78%, Oxygen 21%, all other gases 1%). Using models, charts, etc., review the structure and function of the human respiratory system. Ask, "What force causes air to move from outside the body into the respiratory system?"

DEVELOPMENT

1. Respiration is possible because, at sea level, atmospheric pressure is high enough to drive oxygen through the membranes of the lungs into the blood. Atmospheric pressure is reduced at high altitudes.

2. At altitudes above 10,000 feet the effects of hypoxia (partial lack of oxygen) become increasingly visible. At altitudes of 15,000 to 25,000 feet prolonged exposure to hypoxia results in paralysis, unconsciousness and eventually death.

3. Ask: "What causes hypoxia at high altitudes? What effect will a reduced supply of oxygen have on the mitochondria in the cells of the body? How will the pilot be affected by a reduction in the number of ATP's produced?"

   a. Pulse rate, breathing and blood pressure all increase.
   b. Sense of touch and pain become dull.
   c. Vision is seriously impaired.
   d. Muscular control is decreased.
   e. Movement is slow and awkward.

4. **DANGER:** The pilot is in a state of drunkenness and has a feeling of well-being and is quite relaxed.

Lesson 2

AIM: Physiological Problems in Flight: The Eye

OUTCOMES: 1. Vision is fundamental to flight.
2. Certain vision skills can be improved.
3. Advances in aviation medicine have helped to alleviate some visual problems.

MOTIVATION: Ask students: "Of all the organs in the body which one, if only slightly impaired, would preclude the possibility of flight?"

DEVELOPMENT

1. Using models, charts, etc., review the structure and function of the eye. Define and discuss the following: iris, lens, pupil, retina, optic nerve, rods and cones.

2. Define Depth Perception - ability to judge distances. Since depth perception depends upon learning and experience it can be improved.

3. Night Flying - Review function of rods and cones.

a. Night vision depends largely upon rods.
b. Strong light has a deleterious effect upon rods and must be avoided.
c. Pilots are urged to wear red-lensed goggles 30-40 minutes prior to night flights. These lenses permit cones to see while rods regain full efficiency after exposure to strong light. (Dark Adaptation - process which prepares eyes to see under low illumination.)

4. Discuss the dangers of night flying.

a. Tendency to rely on vision rather than instruments.
b. Mistaking stars for lights.
c. No definite horizon.

PRINCIPLES OF FLIGHT

Suggested Topical Outline

Topic I - The Atmosphere and Theories of Flight

1. The Atmosphere - Its Composition and Behavior
2. The Atmosphere - Pressure, Weight and Density
3. The Atmosphere - Temperature and Humidity
4. The Atmosphere - Wind and Air Currents
5. The Atmosphere - Effects of Altitude and Relative Wind
6. Flight Theory - Bernoulli's Principle
7. Flight Theory - Newton's Action and Reaction Theory

Topic II - Forces of Flight

8. What forces act upon a plane in flight?
9. How is an airfoil especially designed?
10. Lift: Angle of Attack, Relative Wind, Air Density, Wing Area
11. Lift: Flaps, Slots, Spoilers, Boundary Area
12. Drag: Angle of Attack, Boundary Layer
13. Drag: Aspect Ratio, Velocity

Topic III - Aircraft Design and Structure

14. Aircraft Materials: Wood, Aluminum, Steel, Titanium, Nickel, Magnesium, Ceramics, Plastics
15. Aircraft Design: Fuselage, Tail Assembly, Wings (subsonic-supersonic)

Topic IV - Stability and Controls

16. Stability: Positive, Neutral, Negative
17. Stability: Sensitivity of Controls, Dynamic and Static
18. Longitudinal Stability: Relative Wind, Thrust, Drag
19. Lateral Stability: Dihedral, Keel Effect, Sweepback
20. Directional Stability: Vertical Tail Surfaces, Center of Gravity, Throttle
21. Flight Controls: Ailerons, Rudder, Elevators, Trim Tabs

Topic V - Aircraft Instruments

22. Engine Instruments: Oil Pressure, Fuel, Manifold Pressure and Carburetor Temperature Gauges
23. Aircraft Instruments: Air Speed Indicator, Magnetic Compass, Altimeter
24. Aircraft Instruments: Turn-and-Bank Indicator, Rate of Climb Indicator, Artificial Horizons
25. Operating Principles: Electrical Instruments, Mechanical Instruments

Topic VI - High Speed Flight

26. The Nature of Sound: Transmission, Variations in Speed
27. The Nature of Sound: Mach Number, Subsonic, Transonic, Supersonic, Hypersonic
28. Transonic Zone: Air Compression, Variations in Airstream Pressure and Velocity
29. Transonic Zone: Shock Wave Formation (effect on flight)
30. High Speed Design: Thickness-to-Chord Ratio, Aspect Ratio, Structural Strength
31. High Speed Design: Drag-Lift, Sweptback and Delta Planforms, Geometric Wings
32. Solutions to High Speed Heat Problems

Topic VII - Man in Flight

33. Effects of Altitude and Pressure: Man's Ability to Adapt
34. Hypoxia: Symptoms, Prevention, Effect on Breathing
35. Effects of Altitudes: Body Gases, Middle Ear, Eustachian Tube, Sinuses (relief of problems)
36. Decompression Sickness: Causes, Effects, Prevention, Relief
37. High Altitude Flight: Oxygen Requirement, Pressure Problems, Emergency Equipment
38. Vision: Illuminated, Night, Central, Peripheral, Improving Perception
39. What factors affect man's tolerance of "G's," increased acceleration
40. Other Flight Problems: Illusion, Equilibrium (eyes, muscles, inner ear)

Lessons

How Can We Classify Aircraft By Their Flight Principle?

OUTCOMES

1. Aircraft can be classified as

   A. Lighter-than-air
   B. Gliders
   C. Propeller-driven aircraft
   D. Jet-powered aircraft
   E. Helicopters

2. Different types of aircraft serve the various needs of individuals, business and government.

LEARNING ACTIVITIES

1. Exhibit picture and models of various types of aircraft. Have students group the aircraft by their flight principle.

2. Elicit how the various types of aircraft serve different purposes based on their flight principle.

SUPPLEMENTARY INFORMATION FOR TEACHERS

1. Lighter-than-air - Weather observations, astronomy, advertising.

2. Gliders - Pleasure flying.

3. Propeller driven aircraft - Transportation, airmail, air express, patrol and survey, crop dusting, wildlife management, forest fire control, aerial photography, prospecting, air rescue, business flying, recreation flight training, military functions.

4. Jet-powered aircraft - Commercial aviation, business flying, military functions.

5. Helicopters - Interairport flights, industrial flying, disaster relief, law enforcement work, airport to city center service.

What factors determine the amount of lift a wing will produce?

OUTCOMES

1. An increase in the relative wind increases lift. Increasing the angle of attack causes a decrease. The pressure on the upper surface of the wing also increases lift.

2. If the angle of attack becomes too great, air moving over the upper surface of the airfoil will break away from the surface and lift will be decreased.

3. When lift is decreased so that it cannot support the weight of the airplane, the airplane is said to be in a "stall."

LEARNING ACTIVITIES

1. Using the airfoil on the balance from the previous lesson, increase the velocity of air striking the airfoil.

2. Point out the meaning of "angle of attack;" slowly increase the angle of attack of the airfoil. Obtain data on the amount of lift in relationship to the angle of attack.

3. By means of diagrams, show what happens to the flow of air if the angle of attack becomes too great. Introduce the term "stall."

SUPPLEMENTARY INFORMATION FOR TEACHERS

1. Angle of attack is the angle between the chord of an airfoil and the relative wind.

Relative
Wind
Angle of Attack

2. Other factors that influence the amount of lift force are the design of the airfoil, surface area of airfoil and density of air.

What is the Relationship Between Velocity and the Pressure of Fluids?

OUTCOMES

The pressure in a moving fluid is less when the velocity is high and greater when the velocity is low.

LEARNING ACTIVITIES

1. Establish that both gases and fluids are called liquids.

2. Students will do laboratory worksheets.

3. Discuss the applications of Bernoulli's principle in spray devices, passing a large trailer truck in a car, standing near the edge of a subway platform when a train passes.

4. Demonstrate Bernoulli's principle by using a venturi and a manometer.

How is an Airplane Controlled in Flight?

OUTCOMES

1. The airplane is controlled in flight by the moveable control surfaces.

2. The ailerons control movement about the longitudinal axis.

3. The elevator controls movement about the lateral axis.

4. The rudder controls movement about the vertical axis.

5. The pilot controls these moveable surfaces from the cockpit.

LEARNING ACTIVITIES

1. Point out, by the use of models, the location of the ailerons, elevator and rudder. Demonstrate that they are hinged to the trailing edges of the wind and horizontal and vertical stabilizers.

2. Elicit that a movement of any one of the control surfaces changes the shape of the airfoil it is attached to.

3. Demonstrate, with a wind tunnel and model, various positions of the control surfaces and how the model reacts.

4. Discuss how the pilot uses a stick or wheel and pedals to operate these control surfaces. Point out that, to properly execute a turn, a pilot must use all 3 control surfaces simultaneously.

SUPPLEMENTARY INFORMATION FOR TEACHERS

1. The ailerons are so arranged that as one moves up the other automatically moves down.

2. In order to effect a turn, the airplane must be banked as well as pointed in the desired direction, just as highway curves are banked to prevent skids.

THE USE OF THE AEROSPACE THEME IN MUSIC-ART AND HEALTH EDUCATION

MUSIC AND ART DEPARTMENT

- Sample Art Lesson
- Sample Music Lesson

HEALTH AND PHYSICAL EDUCATION DEPARTMENT

- Family Living
- Drug Education
- Health

Music and Art Department

Through the development of aerospace, many parts of the world have become easily reachable within shorter periods of time. As a result, the people of the world have become closer, and there is a constant interchange of culture and ideas. Music and art can be considered universal languages with a similar purpose - bringing the people of the world together and developing a better understanding of each other's cultures.

By taking an imaginary flight, we can land in different countries and study the music and art which are a part of the heritage in each place, thereby instilling a sense of appreciation for the cultures and backgrounds of different people. For example, through the years, many composers and artists have expressed their nationalistic feelings through their works. Smetana's "The Moldau," Grieg's "Norwegian Dances," Respighi's "Fountains of Rome," Villa Lobos' "Train to Caipira," Sibelius' "Finlandia," and Tschaikovsky's "1812 Overture" are some of the musical works which can be used to give some insight to people's political and social conditions as they travel through the countries. Goya's "Disasters of War," Picasso's "Guernica," Daumier's "Uprising" and Diego Rivera's "Murals" are examples of art works which can be studied as part of a unit on imaginary travels to study the cultures of the world.

Folk music and folk art are other areas to be incorporated into the music and art curriculum. Taking a journey through different countries, the conditions of the people as reflected by the layman can be studied through their songs and art works. These works have been inspired by many events in their lives, such as tragedy, war, romance and occupations.

From the performance level, or "active" involvement of the students, many songs and works of art can be created using aerospace as a means of motivation to develop skills and discover talents. For the vocal and instrumental classes, songs such as

"Up, Up and Away," "2001 Space Odyssey," "Fly, Robin, Fly," "Fly Me to the Moon," "Lucky Lindy," and "Star Wars" can be taught. The school song, "Upward Bound," is based on the theme of aerospace. In art, aerospace is an excellent theme. Aircraft, missiles and space vehicles are popular subjects for painting, crafts and sculpture classes. Issues that surround the aerospace community are appropriate subjects for painting, cartooning and advertising design classes. Noise pollution, aircraft mishaps, baggage mishandling and traffic jams are excellent aerospace themes available for exploration in the art class. In ceramics, it is possible to create aerospace-oriented ash trays, dishes and pottery. In fashion design classes, clothing of airline personnel can be studied. The architecture and interior design of airplanes and buildings at airports are other aerospace subjects to be studied by the students. They can study what has been created by artists already, as well as create new ideas of their own.

SAMPLE LESSON:ART

AIM

1. To relate art to everyday activities.

2. To develop a specific skill by learning to render distance in a realistic manner through one-point perspective.
3. To use buildings and runways at an airport as a means of teaching perspective.

MOTIVATION

1. Show slides of buildings drawn in perspective by the artist Utrillo.
2. Show pictures of buildings drawn in perspective by architectural draftsmen.
3. Demonstrate the process on the blackboard.

METHOD

The class is instructed to draw a complex of buildings and runways as imagined by them at an airport. Give students 15 minutes for the creative work. Then spend five minutes making comments and showing them samples of what is being done by others. Then permit students to complete their work.

MATERIALS

Rulers, pencils, erasers and white paper.

SUMMARY

Evaluate the student works at random.
Why are some works successful in showing one-point perspective?
Why did some students fail to show this perspective?
Does a building or runway look realistic if it is out of perspective? Why?

SAMPLE LESSON: MUSIC

As part of a unit which involves an imaginary flight around the world to study the different musical cultures, we arrive in Russia.

AIM

1. To show how national traditions have enriched musical literature.

2. To reveal certain characteristics which are typical of Russian music.

MOTIVATION

1. Give the historical background which inspired Tchaikovsky to write this music. Discuss the war between France and Russia and how the French were defeated primarily by the Russian winter. "1812" is Tchaikovsky's gesture of homage to his homeland.

METHOD

1. Teach the Russian and French national anthems. When they can recognize the melodies, they will be able to hear how Tchaikovsky used them in the Overture.

2. Discuss the sequence of events which are depicted in the music and the themes used for each. For example, the Chorale in the beginning is like a prayer in time of need. Then a military theme is used to symbolize the Russian army. At the end, there is a blaze of glory represented by the bells and cannons.

3. Play the recording, asking students to raise hands as they recognize different themes and anthems discussed.

MATERIAL

1. Recording of the "1812 Overture" by Tchaikovsky
2. Rexograph sheets with main themes written

AUGUST MARTIN

SUMMARY

1. How did Tchaikovsky represent both the French and Russian in the music?

2. What effects in orchestration did he use to create the feelings of need? of strife? of victory?

3. What melodic and rhythmic idioms did he use?

4. Which musical characteristics seem typical of Russian music?

5. What are some of the reasons for a composer to write nationalistic music?

Health and Physical Education Department

The fields of Health and Physical Education are perhaps the more difficult curriculum areas in which we may effectively utilize the aerospace motivational theme. If the premise is correct, use of the aerospace theme should prove effective in stimulating the student to put forth a greater effort in the active educational process.

In Physical Education, we have utilized the Canadian Royal Air Force exercise program with success. We have also begun use of the Air Force Aerobic jogging/running program to improve the cardio-respiratory endurance of our student body.

Initial screening of our incoming freshmen and sophomores has revealed a particular weakness in general fitness levels. A primary cause of this poor general fitness level is our growing cultural aversion to daily exercise. Our students are a valid reflection of this general social malady. To motivate them to want to improve their general fitness level, we embarked upon the aforementioned fitness programs.

In the area of Health, we have also incorporated the aerospace theme in our lesson development whenever feasible. Several topic areas have been effectively explored as valid aerospace theme topics. For example, the areas of jet lag, drug abuse (and the causative agent - stress), environmental education (the effect of noise pollution, as in the case of the SST), and social adjustment (divorce among the members of aviation occupations) are several of the areas in which we have achieved success with the aerospace motivational theme.

SAMPLE LESSON: HEALTH - FAMILY LIVING

I. Topic: Divorce among the aviation occupations.

II. Aim: Why do airline pilots and air traffic controllers have such a high divorce rate?

III. Objective: To have students learn the problems that are inherent in the aeronautic occupations and what they might do to better the situation.

IV. Motivation: Captain's salary - $70,000, Air Traffic Controller's salary - $38,000. Why aren't these individuals who have all this money per annum able to be happy and live a stable life?

V. Pivotal Questions:

1. How might we define divorce?
2. What problems lead to divorce?
3. How can a certain occupation affect the stability of a marriage?
4. How might traveling constantly affect a marriage?
5. How might we prevent or cut down on the high divorce rate among aeronautic occupations? (Suggestions)

VI. Reasons for Divorce

1. Shift work and the marriage.
2. Traveling and the marriage.
3. Why would you become a pilot if you were married?

VII. Homework

1. What are the requirements in order to become a pilot? flight attendant? air traffic controller? etc.

2. What are the benefits of working in the aeronautics field?

3. Would you think going into an aviation occupation worth the possibility of getting a divorce?

4. How might open communication and trust fit into a successful marriage?

5. What else is important in a stable marriage?

Information from The Family, J. Ross Eshlemian
Human Sexuality, J.L. McCarey

AUGUST MARTIN

LESSON - HEALTH - DRUG EDUCATION

I. Topic: Jet Lag and the Pilot
Introduction to drug unit (causative agent - stress)

II. Aim: How does jet lag affect a pilot over a period of time?

III. Objective: To have students understand how the body adjusts to an outside stimulus and how drugs may be harmful to individuals.

IV. Motivation: The change of time in the spring and fall calls for an adjustment in the life-style and functions of the body. What changes do we have to make for this one-hour change?

V. Pivotal Questions

1. What might a pilot do in order to offset the feeling of jet lag?

2. How does jet lag affect the body?

3. How does the body react to a foreign substance being introduced into the body?

4. How efficiently can an individual function under the influence of any drug?

5. What other stressful situations might a pilot experience?

VI. Summary

How do we
Stress -- body reacts -- ?????? -- normal condition
offset condition

VII. Homework

1. List the different ways an individual might deal with stress in both a healthy and harmful manner.

2. Why are there warnings on bottles today more than ever?

3. Read Chapter 8 - Drugs - Tune into Health

   a. Do words for review
   b. Questions

Information from Tune into Health, Drug Curriculum Guide

AUGUST MARTIN

LESSON: HEALTH

I. **Topic:** Environment education, noise pollution, air pollution, collisions, fuel economy.

II. **Aim:** How dangerous is it being close, with living or working, to an airport?

III. **Objective:** To have students understand the nature of pollution and its effects on the body (mentally, physically and psychologically).

IV. **Motivation:** The Concorde will be landing at Kennedy Airport. What problems do you foresee? Improving air travel is important for mankind, but let's examine the positive and negative results to this improvement.

V. Pivotal Questions

1. How does the arrival of the SST affect you in your personal lives?

2. What benefits do you see from having the SST arrive at Kennedy?

3. What negative effects might there be with the arrival of the SST?

4. How might the body respond to the extra burden placed upon it?

5. How can we adjust to an environment change?

VI. Summary

Review positive and negative results of the SST's arrival.

VII. Homework

Take a poll of people in your neighborhood and find out how they feel about the arrival of the SST. Make up at least five good questions to ask.

Information
- noise pollution
- air pollution
- hydrocarbon emissions and ash
- collisions
- fuel economy
- depressurization in Concorde

AUGUST MARTIN

Books: Health Ed curriculum
Tune Into Health

NEW ADDITIONAL EDUCATIONAL OPTIONS AT AUGUST MARTIN HIGH SCHOOL AS OF 1993

Since August Martin High School was established as New York City's first magnet high school with an aviation theme, additional options have been added. Since its inception, the aviation program has been enormously successful, attracting students from all over the city.

Currently the curriculum provides the students with a basic education in the theory and the practical aspects of flight. Starting in the freshman year, the students are given the Aerospace Workshop in which they build model planes while learning the basic principles of flight and what actually makes a plane fly.

In addition to the above, classes are offered in Flight Theory and flying lessons at Republic Airport. State University of New York (SUNY) at Farmingdale provides the practical component of the program. Our flight students log an average of 8 hours flying time per year and become quite proficient in take-offs, landings and flight maneuvers. The course culminates with the written portion of the FAA private pilot's examination.

Approximately 100 students per year take advantage of our flying program. One basic requirement is that a student must be passing in all his/her subjects or he cannot go flying. The actual flying takes place at Republic Airport where our students fly under the tutelage of FAA certified flight instructors. All our students keep an official log book and their flying time is credited toward earning their private pilots license, if they choose to pursue that route after graduation.

We are quite proud of the accomplishments of our students. Some have earned scholarships to Tuskegee, where they participated in a two week workshop of intensive flight training and classroom activities. Some of our graduates have gone on to study aviation at Florida Institute of Technology, Embry-Riddle, Dowling, the Academy of Aeronautics and SUNY Farmingdale. Over the years, we have won many first and second prizes in the yearly "Fly-In" citywide competition among the high schools, and many of our graduates have gone on to pursue careers in engineering, business and the aviation industry including, FAA and American Airlines.

After the ninth grade our students take courses in Technical Drawing, Aerodesign, Computer Aided Drafting and Design (C.A.D.D.) and Communications Systems.

Our C.A.D.D. labs are under constant improvement to provide more computer work stations for more of our students. Within the past year, the number of work stations we support has doubled and some units have been upgraded. In addition, the software has been upgraded to the latest version.

The Communications System Lab is a new offering. At present the curriculum is being adapted for our student population including a bilingual component. The communications system course requires a significant amount of hands-on activities along with reading, writing and math skills. As a result we are using an interdisciplinary approach in conjunction with the English Department to implement the curriculum. One project will be an individual writing assignment for each student which will be done in the English class and typeset, printed and produced in a booklet in the shop.

(This information on recent additions to August Martin High School options was provided by Mrs. Leslie Gurka, Principal.)

Clearly, the August Martin program gives eloquent testimony to the practical value of using a pervasive theme around which to build an educational program. Aerospace, in this instance, is a means to educational ends. Obviously, other themes can be used successfully. For example, following the early success of the August Martin program, a Marine Science High School - Beach Channel School - was developed using the environment of the local water-marine influence on Long Island.

The key point to consider is that an aerospace or other thematic approach to education is feasible. Moreover, the behavior changing impact of such programs yield remarkable benefits for the students as well as the total community.

Any school system that feels there is an opportunity and need to design either a part of an aerospace oriented program or a portion of it, will do well to look at the experiences gained in planning and operating August Martin Comprehensive High School.

While not all of the community, industry, and motivational factors that combined to make the August Martin program successful exist everywhere, clearly the Richmond, California experiment (cited in the Aerospace Magnet Schools - Past - Present - Future section of this publication) proves that much can be done with few resources if the initiative, motivation, and determination are present.

SECTION VI - HISTORIC AVIATION HIGH SCHOOL

In Long Island City, New York the oldest high school in the nation with a continuous program of educating high school students as Aviation Maintenance Technicians (AMTs) operates successfully today as it has since its inception in 1936. Aviation High School has served as a model for other secondary schools. Some of them have adopted parts of the approach used in New York and a few plan for similar comprehensive totally aviation maintenance oriented programs. The South Mountain Aerospace Technology Program in Phoenix, Arizona and the Shawnee High School program in Jefferson County Public School District in Louisville, Kentucky plan parts of their offerings to include aviation maintenance technology.

The largest similar program currently being planned is the Castlemont Aviation High School program in the Oakland, California Unified School District. For any community planning a predominantly aviation maintenance technician-oriented high school aviation program it would be well to consult the schools noted above.

The current Aviation High School brochure describes their program as follows:

GLOSSARY

Aviation Maintenance - The application of mechanic's skills necessary to maintain and repair aircraft.
Avionics - Electronics as it pertains to aircraft systems.
Airframe - The study of the structure of aircraft and all its systems.
FAA - (Federal Aviation Administration) is the governing agency which issues all Airframe and Powerplant licenses.
FCC (Federal Communications Commission) is the governing agency which issues the Avionics license.
Powerplant - The study of aircraft engines and all their systems.

WHAT WE ARE

Aviation High School is a unique specialized co-educational high school with an FAA certified program committed to providing students with:

- a high quality academic and technical education.
- excellent preparation for college.
- aviation maintenance curricula leading to Airframe, Powerplant and Avionics certification.
- skills that prepare for high paying careers in the aerospace industry.

AVIATION HIGH SCHOOL

WHAT WE DO

Aviation Maintenance

- Complete Aviation Curricula which meet all federal requirements for Airframe, Powerplant and Avionics certifications.
- Unique maintenance programs where students may select an area of specialization after the completion of their first exploratory shop year.

	Airframe/Powerplant	Avionics
9th Year	Exploratory	Exploratory
10th Year	Aircraft Sheet Metal	Introduction to Avionics
	Aircraft Woodworking	Introduction to Airframe
11th Year	Basic Airframe	Basic Airframe
	Basic Powerplant	Basic Electronics
12th Year	Advanced Airframe	Avionics 1 and 2
OR	Advanced Powerplant	

Students who satisfactorily complete 4 years of required studies in one license area can elect to take one year of intensive training to obtain a second license.

13th Year	Advanced Powerplant	Advanced Airframe
OR	Advanced Airframe	

In conjunction with our Aviation Maintenance Programs, Aviation High School offers a full New York State regents academic program including honors and advanced placement courses.

REQUIRED COURSES

English
Mathematics
Social Studies
Science
Related Technology
Physical Education
Foreign Language
Fine Arts
Trade Drawing
Music

BILINGUAL EDUCATION - ENGLISH AS A SECOND LANGUAGE

A full ESL/Bilingual program is offered in shop and academic classes with a Native Language Arts class in Chinese and Spanish.

SPECIAL EDUCATION

A self-contained shop program offers special education students the opportunity to acquire entry level skills. This program does not lead to FAA certification.

PARTNERSHIP WITH COLLEGES

Aviation's College and Career Center houses:

- an extensive collection of college catalogs and videos.
- current information related to both aerospace and non-aerospace careers and higher educational programs.
- a metroguide Computer System available to all students.
- college and career counseling services.

Based on an academic achievement and FAA certification, many students wishing to continue on to higher education may receive up to two years of advanced standing worth thousands of dollars in tuition fees from colleges and universities offering Aerospace Technical Programs.

Students are also able to receive advanced standing from most colleges by scoring well on placement examinations in Physics, English, Mathematics and American History. All of these courses are offered as part of our Advanced Placement Program.

PARTNERSHIP WITH INDUSTRY

A full time New York State Employment Counselor aids students and graduates in finding full and part time positions in both aerospace and non-related industries.

The Aeronautical Advisory Committee (AAC) of industry representatives advises our school on the trends and needs of the aerospace industry.

Commercial airlines such as TWA, American, Delta and United participate in our graduation awards ceremonies. These airlines hire many of our graduates and award complete aviation mechanic's tool boxes to select students.

FACULTY

The technical staff consist of talented and dedicated men and women with years of experience in teaching and working in the aviation industry. Several of them work at the major metropolitan airports which keeps them abreast of advances in aviation technology. Many of our shop teachers are graduates of Aviation High School and have come back to teach after successful careers in the industry.

The academic staff is one of the finest in the city. Many of them have years of experience in such diverse areas as engineering, research, the performing arts, publishing, accounting and law.

Several have received national recognition including awards by National Endowment for the Humanities and other prestigious groups.

FACILITIES

Aviation High School is the largest public co-educational aviation maintenance school in the nation. The school houses millions of dollars worth of equipment and resources:

- an aircraft hangar with 20 aircraft including two helicopters.
- 35 shops housing aircraft engines, landing gears, propellers, hydraulic systems, welding booths and complete avionics laboratories.
- computer classrooms.
- science laboratories.
- a library of over 20,000 books, magazines, videos and microfilms.
- a gymnasium for school sporting events.
- complete guidance services.
- an auditorium for seating over 700 students.
- complete health services.
- a cafeteria serving breakfast and lunch.

OUR CLUBS, TEAMS AND ACTIVITIES

School is not just studying. A well-balanced education includes extracurricular activities. Aviation High School provides ample opportunity for students to participate in high school competitive sports teams and clubs.

Academic Olympics
Advocates-Lincoln/Douglas Debate Team
Handball
Honor Society
American Institute of Aeronautics & Astronautics (AIAA)
Junior Achievement
Pegasus Technical Honor Society
Senior Yearbook
Skiing
Soccer
Tennis
The Log (school paper)
Color Guard
Cross Country and Track
Vocational Industrial Clubs of American (VICA)
Volleyball (boys & girls)
Golf
Amateur Radio Club
Intramural Sports
Mock Trials
Band
Baseball
Big Buddies
Bowling
Chess
Video Club
Drill Team
Drama
Flying Club

At Aviation High School, authorities say: "It's not just a high school, it's a career."

The year by year curriculum and description of course offerings at Aviation High School may be noted below:

Aviation High School links an academic program that is traditional in content with the vocational/technical aviation maintenance program. Students develop a solid command of skills in the areas of communications, mathematics and the physical sciences while effectively learning modern technology and preparing for Federal Communications Commission (FCC) and Federal Aviation Administration (FAA) licensing.

Students who complete the program and pass the licensing exam may obtain an:

- FCC Radio Telephone Operator's license with radar endorsement.
- FAA Airframe license - aircraft assembly, inspection, maintenance, repair and overhaul, excluding power plant.
- FAA Powerplant license - reciprocating and gas turbine engines, electrical, fire detecting systems, propulsion, carburation and instrumentation.

Students may obtain both Airframe and Powerplant licenses with an additional year of study.

The choices of opportunities open to Aviation graduates are numerous and varied, including the possibility of going directly to work for one of the major airlines as a high salaried, licensed aviation maintenance technician.

PROGRAMS FOR STUDENTS WITH LIMITED ENGLISH PROFICIENCY:

English as a Second Language
Bilingual Program: Spanish
Bilingual Program: Chinese
Special Education: Aviation Careers - Bilingual/Spanish and Chinese

Grade 9

Introduction to Aviation Maintenance/Aviation Electronics Technology - Program Code Q60Q

Students will combine an understanding of theory of flight with basic hand skills. They will learn aircraft drawing and blueprint reading and will construct both a small wing assembly and a small metal airplane. Those students who succeed in this program will be placed in the Federal Aviation Administration certified shops leading to either an Airframe or Powerplant license. Students who wish to earn both their Airframe and Powerplant or Avionics and Airframe licenses will graduate at the end of their fifth year.

Introduction to Aviation Maintenance/Aviation Electronics Technology - Bilingual/Spanish - Program Code Q60R

Open to limited English proficient students whose language is Spanish.

Introduction to Aviation Maintenance/Aviation Electronics Technology - Bilingual/Chinese - Program Code Q60S

Open to limited English proficient students whose language is Chinese.

Grade 10

Aviation Maintenance Technology: Airframe and Powerplant (approved by the FAA #HW2T887K) - Program Code Q60J

Students will develop their understanding of technical aircraft drawings, blueprint reading and layout and assembly of both wood and metal structures. Basic electricity, D.C. and A.C. circuits will be included. Students will learn to layout, cut, drill, bend and form metal in the fabrications of aircraft sheet metal structure. Principles and theories of aircraft hydraulic/pneumatic systems will be introduced. Students study the fundamentals of Aviation powerplants which include the disassembly, inspection, reassembly, troubleshooting and testing of reciprocating and gas turbine engines. They will work on line aircraft performing inspection, repair and operation of actual aircraft used in the aerospace industry. Students who wish to earn both their Airframe and Powerplant licenses must remain an additional year.

Aviation Maintenance Technology: Airframe and Powerplant - Bilingual/Spanish - Program Code Q60K

Open to limited English proficient students whose dominant language is Spanish.

Aviation Maintenance Technology: Airframe and Powerplant - Bilingual/Chinese - Program Code Q60L

Open to limited English proficient students whose dominant language is Chinese.

Aviation Electronics/Airframe Maintenance Technology - Program Code Q60M

A special program that prepares students to install and maintain avionic equipment. Courses include airframe, basic and advanced electricity and electronics, sheet metal, welding and avionics, communications systems, navigation systems, flight control systems, fuel management systems. Students will be offered advanced mathematics, physics, computer science and advanced circuitry. Students may obtain an FCC radio telephone operator's license with radar endorsement and an airframe license. Students who wish to earn an FCC license and both the FAA Airframe and Powerplant license will graduate at the end of one additional year.

Aviation Electronics/Airframe Maintenance Technology - Bilingual/Spanish - Program Code Q60N

Open to limited English proficient students whose dominant language is Spanish.

Aviation Electronics/Airframe Maintenance Technology - Bilingual/Chinese - Program Code Q60P

Open to limited English proficient students whose dominant language is Chinese.

Special Features:

Male and female students are encouraged to apply to schools and/or programs that have traditionally accepted the opposite gender. This school supports their involvement in non-traditional programs and courses.

Federal Aviation Administration Certification may be earned in Airframe Technology, Powerplant Technology or in both Airframe and Powerplant Technology, as required by Federal Aviation Regulation #147, Part 147.21.

Students who earn both certificates are eligible for employment as aviation maintenance technicians by airlines and aerospace manufacturing companies directly upon graduation.

Students who earn both certificates and wish to further their education in aviation maintenance engineering, aerospace occupations or airport management can receive up to sixty-six college credits in colleges and universities offering these programs.

College preparation: Students participate in a complete academic program. Upon successful completion of Regents level courses and Regents examinations, students will be awarded Regents endorsement of their Aviation High School Diploma.

Aeronautical Pre-Engineering: Seniors who plan to attend engineering colleges and universities receive instruction in advanced placement physics and mathematics, in addition to extensive hands-on experience in electronics, mechanics, mechanical drafting and strength of materials.

Advanced placement courses are available in English, American History, Calculus and Physics.

Westinghouse Research Seminar: Students interested in the sciences or social sciences receive instruction in research methodology utilizing computers, computer-aided resources and statistics. Students use both the on-site and off-site research facilities in order to successfully compete for Westinghouse and college scholarships.

St. John's University offers an extension program in English and social studies.

Applied Economics - a Junior Achievement/Computer Assisted/Economics Honor/Finance option. Students in this program can participate in a Business Basics option in which they teach elementary school students about business.

Mentor Law courses examine the laws involving personal property, legal issues that affect the family and young people, our civil and criminal justice system - its function, concepts and problems - as well as the study of legal techniques and strategies. Students participate in "Moot Court and Mock Trial" competitions.

Speech courses in public speaking, debate, drama and play production. Students participate in Lincoln-Douglas Debate competition.

"State-of-the-Art" Technology includes a twin-engine flight simulator, engine test cells, a hangar with 18 live aircraft, computer classrooms and laboratories.

Industry Collaborative with American Airlines, Federal Express, General Dynamics, Grumman, Lockheed, Mobil Oil (Aviation Division), North American Airlines, Southwest Airlines, Trans World Airways, United Airlines and Westchester Aircraft, Tower Air, Westchester Aircraft Maintenance Association.

Government Collaboratives with the FAA, New York Police Department (Aviation Division) and the Port Authority of New York.

College Collaboratives with the College of Aeronautics, Dowling College, Embry Riddle University, New York Institute of Technology, Parks University, St. John's University, St. Frances College, San Jose State College and S.U.N.Y at Farmingdale.

Airborne Flying Club: All students are eligible to participate in this club. Participating students may qualify for a private pilot's license.

Aerospace Machine/Tool Technology Option: This is an advanced machine shop option for seniors who are interested in tool and die making. Graduates qualify for production and manufacturing jobs in the aerospace and related industries - 4 periods per day; 2 terms.

"Big Buddy" Peer Guidance Program: Upper termers "adopt" all incoming students and assist them in the adjustment to Aviation High School.

BOCES-type Program: Prepares referred students in grades 11 and 12 for entry-level jobs in the aviation industry.

Students who do not take courses required for licensing will complete a general aviation program leading to industry jobs that do not require licenses.

Independent Studies - courses offered in all subject areas for seniors and juniors.

Cooperative Education, Peer Tutoring Program, Training Opportunities Program.

Required FAA Shops:

Grade 9:	2 periods per day.
Grade 10:	3 periods per day.
Grades 11, 12 and optional fifth year:	4 periods per day.

Description of Courses

9th Year

10 Periods Per Week	20 Weeks Per Term
45 Minutes Per Period	2 Terms Per Year

Exploratory (9th Year) - Airframe & Powerplant Technology

Introductory skills and the development of technical understanding dealing with aircraft drawings and blueprint reading, layout and assemblies. The basic electricity segment of this semester's work serves as the basis for continued instruction and includes symbol identification, simple series circuits and Ohm's law calculations.

Subject Code: One Term - 1 Unit of Credit

Instruction centers about the fabrication of aircraft sheet metal structures developing skills and techniques common to the aviation industry. Students learn to layout, cut, drill, bend and form metal hand rivet components upon assembly as required by blueprints.

Subject Code: One Term - 1 Unit of Credit

10th Year

15 Periods Per Week

Wood, Fabric and Finishing Airframes (10th Year)

Instruction centers about the airframe. Accurate layout and careful workmanship in conformance with aviation standards are stressed. A wing panel is constructed and covered with aircraft fabric and doped. Finishing techniques are taught and minor repairs to fabric covering and structure are made. Basic fundamental knowledge and skills are developed in composites for 1/3 of the term.

Subject Code: CA Shop One Term - 1 Unit of Credit

Aviation Sheet Metal (10th Year)

Both hand and machine tool skills are developed while layout, cutting, forming, drilling and assembly of aircraft sheet metal parts are used to construct an airplane control device utilizing steel and aluminum alloys.

Subject Code: SM Shop One Term - 1 Unit of Credit

11th Year

20 Periods Per Week

Second Year Basic - Airframe Technology

The basic airframe term is divided into four quarters. The first quarter is devoted to the principles and theory of the operation of aircraft hydraulic/pneumatic systems. Units are disassembled, adjusted, reassembled, tested to a return-to-services standard.

During the second quarter a student studies electrical systems utilizing full-sized component mock-ups, preparing the student for troubleshooting experiences on live aircraft.

In the third quarter a student will be given the opportunity to learn not only the theory and principles of oxy-acetylene and electric arc-welding, but will also gain hands-on practical experience, as well.

The last quarter of the term centers about the fabrication of aircraft, sheet metal, structural parts and the various types of repairs that are made in accordance with FAA standards.

Subject Code: VABA - 1 Term, 1 Unit of Credit

Instruction in the Basic Powerplant Technology (2 periods per week).

The term centers about the fundamentals of aviation powerplants. Students are taught to disassemble, inspect and reassemble various types of both radial and opposed engines. Students learn engine inspection procedures through the use of precision measuring tools. Interpretation of charts and graphs are discussed. Principles of carburetion and ignition are discussed. Students disassemble, inspect and reassemble carburetors and magnetos.

Subject Code: VABP - 1 Term, 1 Unit of Credit

12th Year

20 Periods Per Week

Area of Specialization: Powerplant Maintenance Technology

A student will spend one year in Powerplant Maintenance Technology.

The fundamentals of aviation powerplants (both reciprocating and gas turbine engines) and its systems are taught. Engines are disassembled, inspected, reassembled, tested and returned-to-service standards. A segment dealing with non-destructive testing as it pertains to powerplant maintenance is also included. Complete powerplant build-up and testing, both in aircraft and engine test cell provide the student with the opportunity to trouble-shoot and diagnose problems in reciprocating and gas turbine engines. Engine electrical, fire detecting systems, generating and starting systems, ignition and carburetion and instrumentation as it applies to powerplants are diagnosed and recommendations for correction are carried out. All types of propellers, including turboprop-engines are included in this one year specialization.

Subject Code: One Year, 2 Units of Credit

Area of Specialization: Airframing Maintenance Technology

A student will spend one year in Airframe Maintenance Technology.

The fundamentals of aircraft assembly, rigging and inspection developed in previous terms are applied to live aircraft. Trouble-shooting, maintaining, overhaul and repair of aircraft must meet an FAA return-to-service airworthiness standard. All aircraft systems and components are diagnosed and recommendations for correction are complied with. A segment of instruction deals with non-destructive testing and composite repairs.

Students who successfully complete the FAA-approved Aviation Maintenance Technician program will be awarded a "Certificate of Graduation" by the FAA and will be eligible to take the examination for the mechanic's certificate of competency without any further work experience requirements.

Aviation High School is an excellent model for any school system planning a comprehensive, high technology based aviation career preparatory program. Modules of this program also serve as examples of a less than total aviation-oriented curriculum.

SECTION VI - PHOENIX UNION HIGH SCHOOL DISTRICT SOUTH MOUNTAIN HIGH SCHOOL CENTER FOR AEROSPACE EDUCATION

MISSION STATEMENTS

Phoenix Union High School District (PUHSD)

The primary mission of the Phoenix Union High School District is to provide a quality education which affords each student the opportunity to develop to his or her maximum potential regardless of personal handicap, ethnic, religious or socioeconomic origin. Quality instruction and effective management will be accomplished using the team approach so that exemplary service to the total community continues to be a hallmark of this school district.

Phoenix Union High School District Magnet Program

The mission of the Phoenix Union High School District (PUHSD) Magnet Program is to ethnically balance the student body at each comprehensive campus by attracting students to specialized learning opportunities which are designed to improve their academic achievement.

South Mountain High School

The mission of South Mountain is to create a community of learners. We believe that:

- parental, community and staff involvement is essential for student achievement.
- productivity is enhanced by a safe and orderly environment.
- high expectations will enhance success.
- all students and staff are responsible for their own learning and behavior.
- all students and staff deserve a quality education program.

South Mountain High School Center for Aerospace Education

The mission of the aerospace program is for all students to gain the knowledge and confidence that will lead them into a career in the aerospace industry.

We believe that:

- parental, community, staff and aerospace industry involvement is essential for student achievement.
- using hands-on and high tech learning activities to enhance the students' learning capabilities will help our students make a more successful transition into the aerospace industry.
- using the same high standards that are used in the aerospace industry in our classes will better prepare our students for their future in an aerospace career.

- academic skills can be enhanced by involving students in a field where they have a high interest.

PHILOSOPHY

The South Mountain High School Aerospace Program will enhance the students' ability to graduate with a wide range of knowledge in the fast changing industry of aviation and aerospace related careers. Student instruction will utilize team approaches, hands-on participation, and multi-sensory techniques. An integral part of the program will be inter-departmental cooperation, administrative support, parental participation, and business industry endorsements.

SOUTH MOUNTAIN CENTER FOR AEROSPACE EDUCATION STATEMENT OF NEED

A major goal of public education is to prepare students to become informed and responsible citizens who actively participate in our democratic society.

Professionals in the aerospace industry report that the public lacks an understanding of the mechanics of our aerospace industry. Educational research indicates varying degrees of apprehension, and misunderstanding among our youth with regard to the careers in the aerospace industry.

Arizona is a rapidly growing and developing state that requires the services of all areas of the aerospace industry. Opportunities currently exist for trained individuals from all levels of our population regardless of ethnic background, ability, achievement or economic status.

It is safe to assume that Anglo students will be attracted to a school whose curriculum focuses on the aerospace industry. At the same time, minority and economically disadvantaged youth need more opportunities to seek careers within the aerospace industry. The aerospace magnet program located at South Mountain High School meets both of these objectives and supports the ongoing PUHSD Office of Civil Rights (OCR) effort, as well.

Professionals in the field of aerospace and related areas support the need for aerospace-related education and career development for young people.

The national forecast for careers in the aerospace industry and related fields will more than double before the year 2000.

PROFILE OF THE AEROSPACE STUDENT

The South Mountain High School Aerospace student comes from a wide range of backgrounds. Their demographics are 1.2% American Indian, 49.8% Anglo, 37.4% Hispanic, 10.7% Black, and 0.8% Asian or other. Many of the aerospace students come from all over the valley. So the student population has a diverse background from low economic and academic to the upper middle class family and over achiever.

About 30% of these students are in the top 20% of their class academically. Twenty percent (20%) of the aerospace students come in with reading, math and science deficiencies. Another important fact is that a majority of the students have at least one at-risk factor that could interfere with them becoming a successful high school graduate.

The typical aerospace student is action oriented, with a desire to do only the required paperwork. The student tends to be interested in high technology and aircraft, and tends to be individualistic with a healthy ego. The student wants to learn how to be more meticulous, and the typical student likes to be in a position of control.

Within the aerospace magnet, there are four major areas. Each of these areas tend to attract students who have the above backgrounds, plus the following additional desires:

Private Pilot - This student likes the feeling of being "free" and is detail minded.

Airframe and Power Plant (Mechanic) - This student tends to be mechanically minded, likes hands-on activities, enjoys accomplishing difficult tasks but likes to see the results immediately. This student is not "book" oriented, but "demonstrated" oriented.

Air Traffic Controller - This student tends to feel like they are the "boss." The student also likes to talk, and is usually very organized to the point of being meticulous. Additionally, this student is very detail oriented.

Technician/Designer/Engineer - This student likes to create original designs or modify existing designs (creative), and the student likes to see how his creation will work. Although paperwork is required for documentation reasons, this person dislikes doing it. This student tends to look at how the details will affect the overall appearance and performance. These students also like to feel as if they are controlling the destiny of their project, and the students like to work with their hands and with machinery.

SOUTH MOUNTAIN CENTER FOR AEROSPACE EDUCATION PROGRAM GOALS

Students will:

- succeed in all classes.
- demonstrate academic achievement by using higher order thinking skills and developing qualities as a life-long learner.
- demonstrate a knowledge and use of decision-making processes.
- improve knowledge, attitudes and skills which will help prevent and help solve everyday challenges.
- develop and maintain staff expertise and up-to-date teaching aids.
- establish and maintain a partnership among the school, educational, legal and business communities.
- provide awareness of aerospace related studies curriculum at South Mountain to people outside the Phoenix Union High School District and its feeder schools.

STUDENT GOALS

Understand and appreciate the role aerospace has played in shaping civilization.
Broaden personal experiences in aerospace-related fields.
Explore vocational opportunities in aerospace-related fields.
Develop an appreciation of the aerospace industry.
Be encouraged to participate in, and contribute to, the aerospace industry.
Clarify attitudes, values and perceptions regarding our aerospace industry.
Develop, strengthen and reinforce reading, communication, computational and research skills.

FOUR-YEAR COURSE OF STUDY

First Year: Fundamentals of Aerospace

Courses	Credit
English 1-2 or 1-2H (Honors)	1
Chem/Physics 1-2 or 1-2H	1
Algebra 1-2 or 1-2H	1
Aerospace 1-2	1
Health/Aero (one semester)	1/2
Flight Safety (one semester)	1/2
Humanities 1-2	1
Practical Arts 1-2*	1

*Reading is required if placement test score is below 58%.

Suggested Humanities Classes: Art
Suggested Practical Arts Classes: Drafting, Lab 2000

Second Year: Career Choices

Courses	Credit
English 3-4 or 3-4H (Honors)	1
Biology 1-2 or 1-2H	1
Algebra 3-4 or 3-4H	1
World Hist/Geography 1-2 or 1-2H (Honors)	1
Aerospace 3-4	1
Foreign Language 1-2	1
Aerospace Design 1-2	1

Third Year: Career Decisions/FAA Written (Flight)
OR
Career Decisions/Air Traffic Control

Courses	Credit
English 5-6 or 5-6H (Honors)	1
Chemistry 1-2 or 1-2H	1
Geometry/Trig 1-2 or 1-2H	1
Am/Az History 1-2 or 1-2H	1
Human Relations	1/2
Accelerated Keyboarding	1/2
Aerospace 5-6 OR Air Traffic Control 1-2	1

Fourth Year: Flight Maneuvers/Private Pilot
Certificate
OR
Air Traffic Control Simulation

English 7-8 or 7-8H (Honors)	1
Physics 1-2 or 1-2H (Honors)	1
Calculus 3-4 or 3-4H (Honors)	1
Free Enterprise/Gov't 1-2 or 1-2H (Honors)	1
Aerospace Lab 1-2 OR Air Traffic Control 3-4	2

Third Year: Career Decisions/Airframe and Power
OR
Aeronautical Technology Applications

English 5-6 or 5-6H (Honors)	1	
Chemistry 1-2 or 1-2H (Honors)	1	
Geometry/Trig 3-4 or 3-4H (Honors)	1	
Am/Az History 1-2 or 1-2H	1	
Human Relations	1/2	
Accelerated Keyboarding	1/2	
Airframe and Power	2	OR
Aerospace Tech Lab 1-2	1	

Fourth Year: Airframe and Power
OR
Aeronautical Technology Applications

English 7-8 or 7-8H (Honors)	1	
Physics 1-2 or 1-2H (Honors)	1	
Calculus 3-4 or 3-4H (Honors)	1	
Free Enterprise/Gov't 1-2 or 1-2H (Honors)	1	
Airframe and Power	2	OR
ICE 1-2	1	

AEROSPACE COURSE DESCRIPTIONS

Aerospace 1-2 (K101) - Two Semester Course, Grade Level 9
Prerequisite: None

Aerospace education provides the student with the basic concepts underlying the cultural and technological impact of the aerospace age.

Flight Safety (K110) - One Semester Course, Grade Level 9
Pre/Corequisite: Aerospace 1-2

This course is designed to complement the required health course. Emphasis will be placed on factors which may influence the safety of individuals involved in aviation. Atmospheric conditions, diet, drugs, physical environment, conditioning, fatigue and their relationship to safety will be among the topics covered.

Aerospace 3-4 (K102) - Two Semester Course, Grade Level 10
Prerequisite: Aerospace 1-2 or Program Manager approval

This course is designed to introduce students to aerospace career opportunities. In addition, it serves as a guide and motivation to students regarding their career choices and future studies in the aerospace field. This course is designed for the second year student in a four-year aerospace magnet program. Goals of this course are to expose all aerospace students to the career base that exists in today's and future labor markets. Student outcome will be measured through comprehensive testing of information and knowledge gained through this course exposure.

Aerospace Lab 1-2 (K103) - Two Semester Course, Grade Level 12
Prerequisite: Aerospace 5-6 (with the FAA Pilot Written Examination passed and a current FAA third class medical)
Recommended: Human Relations in Aviation and Aerospace Careers.
Two Hour Laboratory.

Student will receive classroom instruction, simulator training in state of the art equipment and flight training in a single engine aircraft. All instruction will prepare them to successfully complete an FAA evaluation and acquire a private pilot single engine certificate (private pilot license).

Aerospace 5-6 (K105) - Two Semester Course, Grade Level 11
Required for K103.
Pre/Corequisite: Must be 16 years of age and, of course, Aerospace 3-4 and Human Relations in Aviation is recommended.

Students will receive instruction in aviation fundamentals to include principles of flight, the flight environment, aircraft systems and performance, meteorology, navigation, flight planning and aviation physiology. Students will qualify for and receive an FAA Third Class Medical Certificate. When completed, students will be administered the FAA Private Pilot Written Examination which requires a minimum competency of 70%. Successful completion of both the FAA Third Class Medical Certificate and the FAA Private Pilot Written Examination are required to be eligible for Aerospace Lab 1-2 (K103).

Air Traffic Control 1-2 (K120) - Two Semester Course,
Grade Level 11
Prerequisite: Aerospace 3-4
Corequisite: Human Relations in the Aviation Industry

This course is designed to provide students an introduction to the Air Traffic Control profession. It offers an overview of the air traffic component of the National Airspace System (NAS) and develops an information base upon which a student can visualize the relationship between air traffic control, the other components of the NAS and the transportation industry. This course provides the student with the opportunity to obtain "hands on" experience regarding radio communications between the pilot and controller and interphone communications between ATC facilities. Proper terminology, phraseology and usage will be emphasized.

Airframe and Powerplant 1-2 (K106) - Two Semester Course,
Grade Level 11
Prerequisite: Aerospace 1-2 and Aerospace 3-4
Corequisite: Human Relations in the Aviation Industry

This course will be an on-site training class taught at the Arizona Air National Guard at Sky Harbor International Airport. The students will be able to log the training time for licensing toward an Airframe and Powerplant license. This class will be taught the last two periods of the day. (Class time will start at 1:35 p.m. and end at 4:15 p.m.)

Airframe and Powerplant 3-4 (K106) - Two Semester Course,
Grade Level 12
Prerequisite: Airframe and Powerplant 1-2

This course will be an on-site training class taught at the Arizona Air National Guard at Sky Harbor International Airport. The students will be able to log the training time for licensing toward an Airframe and Powerplant license. This class will be taught the last two periods of the day. (Class time will start at 1:35 p.m. and end at 4:15 p.m.)

Human Relations in the Aviation Industry (H110) - One Semester Course, Grade Level 11-12
Prerequisite: None

This course is designed to prepare students with the human relations skills necessary to be successful in work environments; to develop students' skills in decision-making, goal-setting and managing resources; to develop desirable attributes, qualities and abilities which will contribute to their success as employees and to prepare students for changes that may challenge them in their future work environment.

Aerospace Tech Lab (K115) - Two Semester Course, Grade Level 11
Prerequisite: Aerospace 3-4
Corequisite: Human Relations in the Aviation Industry

This course will expose students to different technical areas where they will explore possible solutions, therefore enhancing their knowledge of structural design and developing their interest in different engineering areas. This course will apply mathematical and scientific principles in a hands-on lab.

AEROSPACE 3-4
AEROSPACE CAREER DEVELOPMENT (K102)

PHILOSOPHY: Exposure to careers and career development in aerospace is an important aspect of this magnet program. Students must gain insight into themselves and the aerospace field in order to make meaningful career decisions.

INTRODUCTION: The aerospace program at South Mountain High School provides opportunities at all levels to explore different aerospace careers. The aerospace careers course provides an additional opportunity to become thoroughly knowledgeable of all facets of aerospace careers. To accomplish this task, a curriculum has been established which is both adaptive and versatile in nature to allow for the rapid changes inherent in the aerospace industry.

PURPOSE: Future Aviation Professionals of America (FAPA) projects that in the next ten (10) years U.S. airlines will hire 52,000 - 62,000 pilots, 100,000 flight attendants and 64,000 maintenance and avionics technicians. In addition, monumental numbers will be needed in airline support personnel and nonairline aviation and aerospace operations. This course will motivate students to capitalize on the overwhelming needs of the industry and establish career paths and career alternatives which are meaningful to them as individuals.

Unit 1 Selecting a Career in Aerospace

Goal: Students will become aware of the vast number of aerospace opportunities and the appropriate criteria for developing a career plan to seek those opportunities.

Timeline: 2 weeks

Content/Concept

1. Before developing a career plan a student should do an initial overview of aerospace.
2. A student should know why it is important to develop a career plan.
3. A student should know that a career plan consists of a career search, a career path and a job search.
4. A career search consists of self-assessment in conjunction with a gathering of facts or research.
5. A student should know that establishing a career path can increase a person's chance of overall success in a given career.
6.* An organized job search can significantly reduce the amount of time and expense of obtaining a desired position.
7. Decision making skills are important in developing a career plan.
8. Goal setting skills are a definite part of making a career plan work.

Learning Objectives

1. Define the term aerospace and describe its major components.
2. Assess why it is important to develop a career plan.
3. Compare and contrast the three criteria for establishing a career plan.
4. Describe the steps involved in doing a career search.
5. Justify how developing a career path can increase an individual's chance for success.
6.* Summarize the advantages in utilizing a job search when obtaining a desired position.
7. Relate good decision making skills with developing a career plan.
8. Explain how goal setting skills can be a positive factor in making a career plan.

Instructional Resources

Text reference: The Career Fitness Program, How to Get a Job
Supplemental reference: Dr. Chuck Ahlstrand, Career Director, Embry-Riddle Aeronautical University; Phyllis Harper-Rispoli, President, PHR & Associates; Gary Cole, CFI, AGI SMHS Advisory Board.

Enrichment Activities

1. Guest speakers: Gary Cole, CFI, AGI or Dr. Chuck Ahlstrand, Career Director, Embry-Riddle Aeronautical University.
2. Set up notebooks.

Evaluation

1. Familiarization quiz.
2. Notebook check.

Comments

The purpose of this unit is to briefly introduce the basic concepts of establishing a career plan to set the stage for exploring aerospace careers.

* Continuity and subject matter dictate that the job search portion of the career plan be taught as a separate unit toward the end of the school year. Upon conclusion of this unit the student will be ready to construct a complete career plan utilizing all three components: career search, career path and job search.

Unit 2	Aerospace Opportunities - Flight
Goal:	Students will establish a career plan for two flying careers - one for pilot, the other for crew member.
Timeline:	6-9 weeks

Content/Concept

1. To establish a career plan for a pilot. The student should start by doing a career search.
2. Upon completion of the career search a student should then complete a career path.

3. Students will then have an opportunity to do a second career plan (on their own) for a crew member position following the same format.

Learning Objectives

Prior to successful completion of this unit, the students will be able to:

1. Complete a trial career plan for a pilot by constructing a career search with the instructor's assistance. (Note: Job search portion of the career plan to be covered as a separate unit.)
2. Make use of their career search by completing a career path for a pilot, again, with assistance from the instructor.
3. Apply the knowledge gained by adopting their own career plan for any other aircrew member position besides pilot i.e., navigator, flight attendant, boom operator or flight engineer.

Instructional Resources

Text Reference: FAA Career Pamphlets, Opportunities in Aerospace Careers. Supplemental reference: videos entitled "Aim High" and "Careers in Aerospace;" ASAP writing forms.

Enrichment Activities

1. Guest speakers representing the following areas: instructor pilot, corporate pilot, Air-Evac pilot, air taxi/charter pilot, cargo/mail/courier pilot, slurry bomber pilot, aerial applicator pilot (cropduster), photo aerial mapping pilot, test pilot, drug enforcement pilot, police department pilot, airline pilots, military pilots, aviation liabilities, state aeronautical agency, general aviation, the B-70, Pan American Clipper pilot, Air-Evac medical technician, flight engineer/first officer, navigator, crew chief, boom operator.
2. Field trips: Cutter Aviation; America West Airlines; U.S. Forest Service; 161st Refueling Group, Army Reserve Unit at 56th Street and McDowell Road.
3. Hands-on-projects/experiences: orientation flights, wooden model construction and reports, construction aircraft carrier.
4. Summarization: 1 newspaper article, 1 magazine article.
5. Shadowing: 2 hours with someone in the field.

Evaluation

1. Guest speaker sheets.
2. Field trip summary.
3. Notebook.
4. Career search for proper resource usage and format.
5. Summarizations.
6. Aircraft identification.
7. Familiarization quiz.

Comments

A job search would normally follow the establishment of a career path. However, this portion of the career plan may be introduced as a separate unit.

Unit 3 Aerospace Opportunities - Air Traffic Control

Goal: Students will establish a career plan for an air traffic controller while working in pairs.

Timeline: 4-6 weeks

Content/Concept

1. To establish a career plan for an air traffic controller, each pair of students should start by doing a career search.
2. Upon completion of the career search each pair of students should then complete a career path.
3. Students will develop productive pair working relationships.

Learning Objectives

1. Complete a career plan for an air traffic controller by constructing a career search.
2. Utilize their career search by completing a career path for an air traffic controller.
3. Work together productively so that each team makes a presentation to: develop individual accountability within the team and develop group/pair skills i.e., listening, setting goals, coordinating efforts, communicating.

Instructional Resources

Text reference: FAA Career Pamphlets, Opportunities in Aerospace Careers. Supplemental reference: videos entitled "Aim High" and "Careers in Aerospace;" ASAP writing forms; content reading including Study Systems.

Enrichment Activities

1. Guest speakers: Air Traffic Controller - tower, enroute, Flight Service Station (FSS).
2. Field Trips: Sky Harbor tower and TRACON; Embry-Riddle Love Field Tower, FSS.
3. Hands-on-experience: presentation and activity facilitated by Ron Dalton, mobile unit activity, weather observation, radar work, aircraft recognition.
4. Summarization: 1 newspaper article, 1 magazine article.
5. Shadowing: 2 hours with someone in the field.

Evaluation

1. Guest speaker sheets.
2. Field trip summary.
3. Notebook check.
4. Aircraft identification.
5. Air traffic control familiarization quiz.
6. Career search for proper resource usage and proper format.
7. Hands-on experience.
8. Summarizations.

Comments

A job search would normally follow the establishment of a career path. However, this portion of the career plan will be introduced as a separate unit.

Unit 4	Aerospace Opportunities - Airframe/Powerplant and Avionics
Goal:	Students will establish a career plan for an airframe/powerplant or avionics position using groups of three students.
Timeline:	4-6 weeks

Content/Concept

1. To establish a career plan for an airframe/powerplant or avionics position. Each group of students should start by doing a career search.
2. Upon completion of the career search, each group of students should complete a career path.
3. Students will develop productive working relationships.

Learning Objectives

Prior to successful completion of this unit, the students will be able to:

1. Complete a career plan for an airframe/powerplant or avionics position by constructing a career search.
2. Utilize their career search by completing a career path for an airframe/powerplant or avionics position.
3. Work together productively so that each team makes a presentation to: develop individual accountability within the team and develop group/pair skills i.e., listening, goal setting, coordinating efforts, communicating.

Instructional Resources

Text reference: FAA Career Pamphlets, Opportunities in Aerospace Careers. Supplemental reference: videos entitled "Colorado Aero Tech," "School of Aviation Maintenance Technology," "Alabama Aviation & Technical College;" content reading including study systems and ASAP writing forms.

Enrichment Activities

1. Guest speakers: FBO - Aircraft Maintenance & Avionics, Airline - Aircraft Maintenance & Avionics, Aerospace Manufacturing - Assembly & Test, Government Careers - FAA, US Customs, DEA, Police, DRS, Military Aerospace - Army, Navy, Air Force, Marine Corps, Coast Guard.
2. Field Trips: 161st Refueling Group at Sky Harbor Airport; America West Airlines; Rice Aviation.
3. Hands-on project: assemble small engine.
4. Summarization: 1 newspaper article, 1 magazine article.
5. Shadowing: 2 hours with someone in the field.

Evaluation

1. Guest speaker sheets.
2. Field trip summary.
3. Notebook check.
4. Career search for proper resource usage and proper format.

5. Hands-on project.
6. Summarizations.
7. Familiarization quiz.

Comments

A job search would normally follow the establishment of a career path. However, this portion of the career plan will be introduced as a separate unit.

Unit 5 Aerospace Opportunities - Technical Careers

Goal: Students will establish a career plan for a technical career while working in pairs.

Timeline: 4-6 weeks

Content/Concept

1. To establish a career plan for a technical career each pair of students should start by doing a career search.
2. Upon completion of the career search, each pair of students should then complete a career path.
3. Students will develop productive working relationships.

Learning Objectives

Prior to successful completion of this unit, the students will be able to:

1. Create a career plan for a technical career by completing a career search.
2. Create a career plan for a technical career by completing a career path.
3. Work together productively so that each team makes a presentation to develop individual accountability within the team and develop group/pair skills i.e., listening, goal setting, coordinating efforts, communicating.

Instructional Resources

Text reference: FAA Career Pamphlets, Opportunities in Aerospace Careers. Supplemental reference: videos entitled "P.T.Q. II," "Winning Aerospace - the Next Decade," "The Tech Group - Corporate

Pursuit of Excellence," "Precision Die and Stamping;" content reading including study systems and ASAP writing forms.

Enrichment Activities

1. Guest speakers: aerospace engineering, RF engineering, manufacturing engineering.
2. Field Trips: Allied Signal; Motorola.
3. Hands-on project: Assemble electronic kit - presentation and activity facilitated by Dean Clemit.
4. Summarization: 1 newspaper article, 1 magazine article.
5. Shadowing: 2 hours with someone in the field.

Evaluation

1. Guest speaker sheets.
2. Field trip summary.
3. Notebook check.
4. Career search for proper resource usage and proper format.
5. Hands-on project.
6. Summarizations.
7. Familiarization quiz.

Comments

A job search would normally follow the establishment of a career path. However, this portion of the career plan will be introduced as a separate unit.

Unit 6	Aerospace Opportunities - Space
Goal:	Students will establish a career plan for a space career while working in groups.
Timeline:	4-6 weeks

Content/Concept

1. To establish a career plan for a space career each student should start by doing a career search.
2. Upon completion of the career search each student should then complete a career path.
3. Students will develop productive working relationships.

Learning Objectives

Prior to successful completion of this unit, the students will be able to:

1. Create a career plan for a space career by completing a career search.
2. Create a career plan for a space career by completing a career path.
3. Work together productively so that each team makes a presentation to develop individual accountability within the team and develop group/pair skills i.e., listening, goal setting, coordinating efforts, communicating.

Instructional Resources

Text reference: FAA Career Pamphlets, Opportunities in Aerospace Careers. Supplemental reference: Getting Comfortable Teaching With Space.

Enrichment Activities

1. Guest speakers: Pam Ross, Allied Signal - U.S. Space Foundation; Central Arizona College Astronomy Department; Lowell Observatory, Flagstaff; NASA Ames Research Center, Moffett Field, California; Orbital Sciences Corporation, Space Data, Chandler.
2. Field trips: Flandrau Planetarium, Tucson; Central Arizona College, Casa Grande (Star Party).
3. Hands-on project: "Thanks to Mr. Albert Einstein;" construction of a national AER-Space plane; model rocket club; "Houston We Have a Problem;" "Project Freedom."
4. Summarization: 1 newspaper article, 1 magazine article.
5. Shadowing: 2 hours with someone in the field.

Evaluation

1. Guest speaker sheets.
2. Field trip summary.
3. Notebook check.
4. Career search for proper resource usage and proper format.
5. Hands-on project.
6. Summarizations.
7. Familiarization quiz.

Comments

A job search would normally follow the establishment of a career path. However, this portion of the career plan will be introduced as a separate unit.

SOUTH MOUNTAIN

Unit 7 Aerospace Opportunities - Other Aerospace Careers

Goal: Students will establish a career plan for one other aerospace career. Note: If time permits, students could do a career plan for one or more additional aerospace careers including part-time positions.

Timeline: 4-6 weeks

Content/Concept

1. To establish a career plan for one additional aerospace career each student should start by doing a career search.
2. Upon completion of the career search each student should then complete a career path.

Learning Objectives

1. Create a career plan for one other aerospace career by completing a career search.
2. Create a career plan for one other aerospace career by completing a career path.

Instructional Resources

Text reference: FAA Career Pamphlets, Opportunities in Aerospace Careers.

Enrichment Activities

1. Guest speakers: aircraft sales, sport aviation, aircraft photography, aviation historian.
2. Field trips: Champlin Fighter Museum or Pima Air Museum.
3. Hands-on project: orientation flight - soaring (Saturday); aircraft photography; American Aviation Historical Society meetings.
4. Summarization: 1 newspaper article, 1 magazine article.

Evaluation

1. Guest speaker sheets.
2. Field trip summary.
3. Notebook check.

4. Career search for proper resource usage and proper format.
5. Hands-on project.
6. Summarizations.

Comments

A job search would normally follow the establishment of a career path. However, this portion of the career plan will be introduced as a separate unit.

Unit 8 Aerospace Opportunities - Job Search

Goal: In order to bring the career plan to a successful completion students will learn to establish a job search for one or more aerospace careers.

Timeline: 2-4 weeks

Content/Concept

1. To establish a complete career plan students should do a job search.
2. The student should complete a career plan in its entirety - including career search, career path, job search - regarding one or more aerospace careers.

Learning Objectives

Prior to successful completion of this unit, the students will be able to:

1. Create a job search in preparation for the construction of a complete career plan.
2. Utilize previously acquired information to devise a career plan to include a career search, career path and job search.

Instructional Resources

Text reference: FAA Career Pamphlets, Opportunities in Aerospace Careers, The Career Fitness Program, How to Get A Job.
Supplemental reference: information interviews, sample resumes, application forms, ASAP writing forms.

Enrichment Activities

1. Guest speakers: Human Resources Division - Allied Signal; America West Airlines; Southwest Airlines; Cutter Aviation.
2. Field trips: Embry-Riddle Aeronautical University.
3. Hands-on project: Information interviews, network file, resume preparation, cover letters, thank you letters, application completion, phone interviews, job interviews.
4. Summarization: 1 newspaper article, 1 magazine article.

Evaluation

1. Guest speaker sheets.
2. Field trip summary.
3. Notebook check.
4. Job search for proper resource usage and proper format.
5. Hands-on project.
6. Summarizations.
7. Final Career Plan.

AEROSPACE DESIGN 1-2 (K104)

Philosophy: The aerospace program recognizes the importance of aerospace in the rapidly changing world around us. Aerospace students will assume responsibilities and obligations of the future of aviation and they will need to make informed decisions. This class will expose students to beginning design theory.

Introduction: This is a laboratory-centered course, where students will have the opportunity to learn how an aircraft is designed from its conception to when it is ready to be manufactured. Throughout the course, students will be using basic computer and manual drafting skills to foster critical thinking and documentation skills as the student designs an aircraft.

Purpose: This course is intended to make the student aware of design considerations and career possibilities in the aerospace industry.

Unit 1 Introduction to Design

Goal: Students will determine how this course will help them to evaluate career fields involved with designing an aircraft.

Timeline: 1 week

Content/Concept

1. Drafting and design are important in the aerospace industry, as it allows a pilot to understand how aircraft operate. Major airlines seek pilots who have backgrounds as engineers or in other aspects of the aerospace field. Aeromechanics and technicians have to know how to use blueprints, which are the final results of drawings.
2. A broad spectrum of careers exist in the aerospace industry, many of which use the skills of drafting and design.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Generate rationale for studying drafting and aircraft design.
2. Discuss the many aerospace careers which involve some aspect of design.

Instructional Resources

Text reference: Exploring Drafting: Fundamentals of Technology, Chapters 1 and 2. Supplemental reference: wiring and system diagrams, aircraft blueprints.

Enrichment Activities

1. Interview professionals working in the aerospace industry and write a report on how aircraft design affects their job.
2. Secure samples of drawings used by the following industries: aerospace, building construction, structural, manufacturing, map making, electrical and electronic.
3. Make a study of the "Help Wanted" column in the daily newspaper for a period of two weeks. Prepare a list of aerospace jobs which would use drafting depicting salaries, minimum requirements and benefits.
4. Produce a list of aerospace jobs in the local area by referencing the local phone directory.

5. Produce a list of aerospace jobs in the local area by referencing the Department of Economic Security (D.E.S.) job service.

Evaluation

1. Oral presentations, written tests, lists and diagrams.

Unit 2 Review of Drafting

Goal: Students will have an understanding of drafting techniques and equipment.

Timeline: 4 weeks

Content/Concept

1. Sketching is a basic fundamental which helps a person to gain a better idea of how a product might look.
2. Drafting equipment and techniques will be used to produce simplified scaled drawings.
3. Many students do not understand the fundamental differences between sketching and drafting.
4. Multiview drawings are a means of seeing an object from at least three different views, putting it into a third plane, and relating measurements to all sides of the object.
5. Blueprint reading is a necessary skill for a pilot, engineer, mechanic and technician.
6. The ability to read and draw a schematic is a skill which an engineer must have.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Demonstrate how to sketch an object.
2. Produce drawings using proper drafting techniques, symbols and equipment.
3. Compare and contrast sketching and drafting techniques.
4. Compare and contrast 2-D drawings with a 3-D counterpart.
5. Extract basic information from a blueprint.
6. Draw and interpret schematics for a design.

Instructional Resources

Text reference: Exploring Drafting: Fundamentals of Technology, Chapters 3 through 9. Supplemental reference: Field trip to McDonnel Douglas or Garrett design areas, aircraft blueprints.

Enrichment Activities

1. Sketch aircraft silhouettes and identify the aircraft.
2. Prepare a display on drafting equipment, and/or drafting techniques.
3. Write a report on the different drafting scales.
4. Using a photo or drawing of an aircraft, place a sheet of tracing vellum over it and sketch in the various geometric shapes used in its design.
5. Research the variety of lettering styles, alphabets and symbols available with mechanical lettering devices.
6. Build a hinged box out of clear plastic which can be used to demonstrate the unfolding of an object into its multiview parts. Place a prop inside the box and trace the profiles onto the box.
7. Using a cutaway object, draft a sectional view showing the internal features. Use both the object and completed drawing as a teaching aid.
8. Write a report of why auxiliary views are important.
9. Survey industries in your area. What type of reproductions are used by architects, contractors and manufacturers?
10. Prepare a display showing American National Safety Institute (ANSI) standards.

Evaluation

Drawings, lists, oral presentations, written tests and demonstrations.

Unit 3	Computer Aided Drafting and Design (CADD)
Goal:	Students will demonstrate basic techniques for using the computer to create and view drawings.
Timeline:	4 weeks

Content/Concept

1. To view a drawing is one of the first steps in learning how to use a CADD program.
2. To create a drawing is a fundamental step in the drafting and design process.
3. Changes occur regularly during the design process, so drawings often need to be edited.
4. Drawings are clarified with the use of dimensions, notes and other symbols, which help the technicians to build the parts.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Demonstrate the ability to use menus and function keys to change the angle from which a drawing can be viewed.
2. Create 2-D drawings using a computer aided drafting and design program.
3. Demonstrate how to edit a drawing.
4. Demonstrate how to use drafting symbols in a computer aided drafting and design program.

Instructional Resources

Text reference: Exploring Drafting: Fundamentals of Technology, Autocad Release 10: For the Beginner tapes and booklet
Supplemental reference: AutoCad manuals, teacher-made handouts.

Enrichment Activities

1. Prepare a display on computer aided design drafting (CADD) techniques.
2. Using a cutaway object and the computer, draw a sectional view showing the internal features. Use both the object and completed drawing as a teaching aid.
3. Create an isometric drawing using the computer.
4. Write a report about how CADD has changed the designer's job.

Evaluation

Drawings, lists, oral presentations, written tests, demonstrations and computer printouts.

Comments

Acquire or make self-paced learning packets. (Need to get a "pure" Autocad program, not one that contains 2 different releases.)

Unit 4	Design Applications
Goal:	The student will analyze how an aircraft is designed.
Timeline:	14 weeks

Content/Concept

1. The design process involves many multifaceted functions.
2. An aircraft's mission and required specifications have an impact on the overall design of the aircraft.
3. An aircraft's design layout is the guideline by which an aircraft is built.
4. A project requires a plan.
5. Models and mock-ups are an integral part of the design process.
6. Testing is an integral part of the design process.
7. Mock-ups are necessary to eliminate design problems.
8. Designers must be able to justify why their design is the best.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Demonstrate how to use the design process to create an aircraft component.
2. Determine the requirements to produce an aircraft according to specifications and/or a mission profile.
3. Create a design layout.
4. Produce a schedule to plan a design.
5. Create original models and mockups which can be tested for structural integrity, flight characteristics and human factor flaws.
6. Analyze how different designs withstand stresses which are applied during flight. Analyze the feasibility of a design according to test results.

7. Create a mock-up of his/her design to test for functional feasibility.
8. Research and document design choices.

Instructional Resources

Text reference: Exploring Drafting: Fundamentals of Technology. Supplemental reference: Airframe Structural Design, field trips, guest speakers, systems specific documents, FAA regulations.

Enrichment Activities

1. Procure and interpret a specification from industry.
2. Using a blueprint, identify areas where human factor considerations were included.
3. Explain why certain structural considerations were used in the design of an aircraft's anatomy.
4. Write a paper to compare the drive system and/or powerplant of a car versus an aircraft.
5. Prepare at least three different flyable models and compare/contrast the aerodynamics of each.
6. Prepare sketches of at least three different types of landing gear and state the type of aircraft for which they would be used.
7. Select a design problem and produce basic sketches and drawings.
8. Write a report describing the control systems of an automobile that will compare/contrast with the control systems of an aircraft.
9. Compare/contrast an airplane's control system and a rotorcraft's control system.
10. Review technical magazines and clip illustrations that show models, mockups and prototypes being used for engineering, educational, planning and other purposes. (Do not cut up library copies.)
11. Visit a professional model maker in your community. With permission, make a series of slides showing examples of various models and how these models are made. Then, present the information to your class.
12. Draw a schematic of the wiring needed to operate a radio controlled aircraft.
13. Explain how a wind tunnel works and include a diagram.
14. Create a display showing electrical symbols and components.
15. Build a model which can be used in a wind tunnel and test it, if possible.
16. Interview a person involved in aircraft design.
17. Make a flow chart showing a typical week's schedule. Suggestions: family activities, study plans, a typical day, etc.

Evaluation

Drawings, oral presentations, written tests, diagrams and demonstrations.

Comments

Do wind tunnel testing and have students modify their designs until a "flyable" design is achieved. If possible, interface with wood shop, arts, marketing and video classes.

Unit 5	Structures
Goal:	The student will analyze different aircraft structures to determine and defend the best structure for a design.
Timeline:	6 weeks

Content/Concept

1. In order to produce a good design, knowledge of stresses before, during and after a flight is necessary.
2. Designers need knowledge of material strengths and weaknesses.
3. The structural design used in the fuselage and wing, and for the landing gear, will determine the mission that aircraft can perform and the type of maintenance involved.
4. Items are added to the aircraft to enhance the flight characteristics.
5. A designer must know how to determine the center of gravity of an aircraft in order to ensure a safe and stable flight.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Explain how the five classifications of stress impact an aircraft.
2. Identify and analyze materials used in old and new aircraft.
3. Identify and describe the different types of structures used in fuselages, wings and landing gears. Analyze how the design of a structure impacts the aerodynamics of an aircraft.

4. State the purpose of flaps, slats, spoilers and drag devices.
5. Calculate the weight, balance and load factors of an aircraft's design.

Instructional Resources

Text reference: Aerospace: The Challenge, Chapter 3-3, pages 3-15 through 3-21. Supplemental reference: model aircraft, actual aircraft, field trips, aircraft maintenance hangar.

Enrichment Activities

1. Analyze the tensile strength of five major materials used in aircraft construction and identify the best areas for their usage.
2. Write a paper stating strength and weaknesses of the different fuselage structures.
3. Create composite samples.
4. Acquire different types of composites and test their strengths.

Evaluation

Written exam, oral presentation, construction, written assignments, drawings, design testing.

Unit 6 Aircraft Propulsion

Goal: The student will analyze how different aircraft propulsion systems affect the stresses upon an aircraft structure.

Timeline: 2 weeks

Content/Concept

1. There are two basic types of aircraft engines.
2. Many small aircraft still use the reciprocating engine as it is the most efficient for short flights.
3. Turbine engines are used on many modern aircraft.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Name and describe the two basic types of aircraft engines.
2. Identify parts of a reciprocating engine. Describe how a reciprocating engine works.
3. Identify the basic sections and parts of a turbine engine. Compare and contrast the different types of turbine engines. Describe how the turbine engine works.

Instructional Resources

Text reference: Aerospace: The Challenge, Chapters 3-4.
Supplemental reference: Garrett posters, APU and turbine parts, field trip to Garrett.

Enrichment Activities

1. Posters depicting engine parts and operations.
2. Charts comparing and contrasting the different turbine engines.

Evaluation

Written exam, assignments, oral presentation, wind tunnel testing.

Unit 7	Original Aircraft Project
Goal:	The student will use the design process to create an original design, produce a model and document all steps of the process.
Timeline:	4 weeks

Content/Concept

1. Using the skills that are used in industry and that have been taught/learned this year, the skills now need to be applied. The final product and presentation needs to be in both a written documented form as well as an oral presentation.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Establish a development schedule.
2. Generate an overall sketch of an original aircraft using drafting techniques to produce design layouts and schematics.
3. Construct a model for marketing.
4. Create documentation to support the designed aircraft.

Instructional Resources

Text reference: Exploring Drafting: Fundamentals of Technology.
Supplemental reference: teacher handouts.

Enrichment Activities

Since this is part of the final exam, there are no enrichment activities.

Evaluation

Written exam, oral presentation, diagram, drawing, construction and group cooperation.

Comments

The project is designed to be done in groups of four or five students. They will form their own company and will be graded jointly.

Request assistance on judging the final presentation from the Advisory Board.

AEROSPACE TECHNOLOGICAL LAB 1 & 2 (K115)

PHILOSOPHY: The aerospace program recognizes the importance of advancing technology in our rapidly changing world. These changes will require personnel who can adapt to change and implement creative solutions. There is more than one way to solve a problem, therefore students need to learn how to analyze problems and create their own solutions.

INTRODUCTION: This course is designed to use the concept that most students acquire the greatest amount of knowledge by exploring new concepts. Therefore, students will work in pairs and follow written directions from the "technical Learning Manuals" (modules). Each work station has a module which will take approximately one week to complete. The students move to a different station every week, so different concepts can be learned. The students will complete at least fifteen modules every semester. The modules can be changed as the year progresses, or as technology advances.

PURPOSE: This course is intended to help the students develop self-initiated thinking skills and to allow them to explore different areas of technology which impact the aerospace industry, their daily lives and the world.

Unit 1 Lab 2000 - Introduction

Goal: Students will demonstrate proper computer usage and Lab 2000 procedures.

Timeline: 1 week

Content/Concept

Without knowledge of the following a student cannot use Lab 2000:

1. Computer usage.
2. Interactive modules.
3. Technology islands.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Use computer nomenclature. Operate a computer. Apply appropriate safety procedures when operating a computer.
2. Record information as directed in the modules. Apply information which is presented in the modules.
3. Describe the technology islands, the computer consoles, the modeling stations, the technological platform and their components.

Instructional Resources

Text reference: Mousing Around With the MacIntosh, Getting to Know the Apple IIGS, Tour of the Technology Island Featuring: the Computer Console, the Modeling Station and the Technology Platform. Supplemental reference: Apple Polishing, Apple IIe Equipment Check-out.

Evaluation

Written, oral, demonstrations, drawings, presentations.

Unit 2	Design
Goal:	The student will design, construct and analyze tests on a three-dimensional object.
Timeline:	4 modules

Content/Concept

When building an aircraft, the design and construction impacts on the results of tests, therefore the student can gain first hand experience by integrating the following areas:

1. Design.
2. Construction.
3. Stress test.
4. Aerodynamics test.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Design and plan the construction of a structure, vehicle or a component of a vehicle.
2. Build a structure, vehicle or a component of a vehicle.
3. Predict what type of structure is the strongest and formulate why. Perform stress tests on different structures and compare your prediction with the actual results. Deduce why the results occurred as they did.
4. Describe how a wind tunnel is constructed and how it functions. Demonstrate how to use a wind tunnel and how to take measurements. Conduct and photograph wind tunnel tests of differently shaped objects. Design a working vehicle and run a simulated performance and aerodynamics check.

Instructional Resources

Text reference: Almost Broken: Structural Stress Analysis, An Introduction to Aerodynamic Testing: Featuring the TransTech Wind Tunnel, Wind Tunnel Assembly, Fast-track Computing with Car Building. Supplemental reference: Lab 2000: Classroom Reference Manuals.

Enrichment Activities

1. Research and design an aircraft and perform tests involving structural components and aerodynamics to assess performance characteristics.
2. Report on how industry actually tests components to improve design and/or verify functional applications.

Evaluation

Written, oral, demonstrations, drawings, presentations.

Unit 3	Computer Simulation/Robotics
Goal:	The student will build a working model with a specific function and interface it with a computer.
Timeline:	6 modules

Content/Concept

Robotics and computer simulations are ways industry is advancing to improve safety and productivity. The following are needed for developing robotics:

1. Model building.
2. Physical simulation.
3. Computer simulation.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Construct models of powered devices and machines. Identify and define a set of functional categories into which all

machine parts can be classified.
2. Build and wire functional models of devices and machines. Manipulate and assemble modular construction components and motorized models.
3. Connect a control interface to a computer and operate a model. Use logic circuits to control a model or robot. Recognize the relationship between lines of computer code and control actions.

Instructional Resources

Text reference: How to Make a Robot Work for You, Science of Control: Featuring Multibotics, Modeling Physical Simulators, Interfacing With a Computer, Modeling the Mean Machine With LEGO, Micro Electronics for All, See-Through Machines: Featuring Capsela. Supplemental reference: Lab 2000: Classroom Reference Manuals, Alpha Electronics.

Enrichment Activity

1. Design and build a remote controlled robot.
2. Research and write a report on how industry has advanced through the use of robotics.

Evaluation

Written, oral, demonstrations, drawings, presentations.

Unit 4	Applied Aerospace Technology
Goal:	The student will modify basic designs, construct models, run tests and collect data while applying aerospace technology.
Timeline:	6 modules

Content/Concept

Aerospace technology has advanced by combining old methods with new ideas. The following are old areas, but new ideas are used to improve them:

1. Satellite communication systems.
2. Rocketry.

3. Aerial photography.
4. Piloting of aircraft.
5. Piloting paper airplanes.
6. Introduction to controlled gliding.
7. Speed/motion.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Identify the major features of a satellite communication system. Conduct tests of a satellite communication system and log test results. Design, construct and operate a working model satellite system.
2. Construct a rocket which will interface with a computer. Launch a rocket, using proper safety procedures, and record data from the flight.
3. Install a photo unit into a rocket and record the rocket's flight.
4. Prepare a flight plan and use it on a simulated flight.
5. Design and build aircraft out of paper. Fly this plane and modify it so to get the best possible flight.
6. Modify the design of a glider using the computer. Fly the modified glider over different simulated terrains and analyze the results.
7. Measure how speed is affected by weight and design.

Instructional Resources

Text reference: Say it by Satellite, A Space-Age Launch, Flying by the Seat of Your Computer: Featuring Flight Simulator, Pilot Paper Airplanes, Introduction to Controlled Gliding, Faster Than a Speeding .... Supplemental reference: Lab 2000: Classroom Reference Manuals.

Enrichment Activity

1. Research and report on one of the content areas, and how it has impacted, or might impact the aerospace industry.
2. Describe the interrelationship of the content area as it affects the aerospace industry.

Evaluation

Written, oral, demonstrations, drawings, presentations.

Unit 5 Pneumatics

Goal: The student will design, construct and evaluate pneumatic circuits.

Timeline: 2 modules

Content/Concept

Pneumatics and hydraulics use the same principles and are an integral part of an aircraft's system.

1. Compressed air.
2. Pneumatic circuitry.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Recognize the distinguishing attributes of absolute pressure, overpressure and underpressure and that compressed air is an energy storage system. Construct a model piston compressor.
2. Draw a schematic of a pneumatic circuit. Build and explain different pneumatic circuits.

Instructional Resources

Text reference: A Preview of Pneumatics: Featuring Fischertechnik, Pneumatics Has An Air About It. Supplemental reference: Lab 2000: Classroom Reference Manuals.

Enrichment Activities

1. Design a hydraulic system and explain how it can be tested using a non-toxic substance.
2. Compare and contrast pneumatic and hydraulic systems and their uses.

Evaluation

Written, oral, demonstrations, drawings, presentations.

Unit 6	Electricity
Goal:	The student will design, construct and evaluate electronic circuits.
Timeline:	3 modules

Content/Concept

To troubleshoot electrical problems in an aircraft, knowledge of electrical circuits is a necessity for all phases of the aerospace industry.

1. Electronic circuitry.
2. Logic circuitry.
3. Systems circuitry.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Identify and draw electronic symbols. Draw a schematic of an electronic circuit. Demonstrate how to wire electronic circuits. Compare and contrast different electronic circuits.
2. Demonstrate how to wire a circuit to perform specified functions.
3. Apply logic and different electrical systems to the wiring of electronic circuits.

Instructional Resources

Text reference: Electricity: Getting Into the Flow, Electricity: Monitoring the Flow, Micro-Electronics For All, Alpha Electronics. Supplemental reference: Logic Module, Lab 2000: Classroom Reference Manuals.

Enrichment Activities

1. Obtain schematics of aircraft and of the wiring of their essential and non-essential busses. Explain how these can be used to learn the aircraft systems, emergency procedures and to help cut maintenance costs.
2. Explain how logic modules can be used to troubleshoot a system. Create a flow chart to show this process.

Evaluation

Written, oral, demonstrations, drawings, presentations.

Unit 7	Drafting/Drawing
Goal:	The student will create graphic plans for constructing a modular component model using working drawings, scaled drawings and computer-aided drafting and drawings.
Timeline:	6 modules

Content/Concept

The ability to use the computer to produce technical illustrations, working, multi-view and scaled drawings is in high demand within the aerospace industry.

1. Computer-assisted painting and drawing.
2. Working drawing.
3. Scale drawing.
4. Computer-aided drafting and drawings.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Describe the differences between computer-painted and computer-drawn images. Demonstrate how to alternate between the paint and draw modes to create an object. Apply computer program functions to manipulate on-screen images.
2. Using computer-assisted drawing software, produce both two-dimensional and three-dimensional drawings. Demonstrate options which shorten the time needed to produce a drawing. Use a proportioning system.
3. Using computer-assisted drawing software, produce drawings to scale. Demonstrate how to change the scale of drawings. Use text and dimensions to clarify a drawing.
4. Create graphic plans for constructing a modular component model.

Instructional Resources

Text reference: Super Painting, Super Drawing, The Power of Paint, Show It Like It Is ... with MacDraw, Modules, Modules, Everywhere, Designing with MacTechnic CAD/Components.
Supplemental reference: Lab 2000: Classroom Reference Manuals.

Enrichment Activities

1. Do both a CADD and manual multiview or working drawing of an intricate object, include the scale and other clarification information.
2. Write a report on why CADD is an important tool for the aerospace industry.
3. Write a report on the history of CADD and forecast future changes due to CADD.

Evaluation

Written, oral, demonstrations, drawings, presentations.

Unit 8	Manufacturing
Goal:	The student will build and analyze different types of transmission systems.
Timeline:	2 modules

Content/Concept

All aircraft have a transmission system and personnel employed in the aerospace industry need to have knowledge of how it works.

1. Power transmission.
2. Material processing.*
3. Thermoforming process.*

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Identify and define a set of functional categories into which all machine parts can be classified. Build models which are powered by different types of transmissions.

Compare and contrast the different types of transmission systems and where they might be used in an aircraft.

2. Describe fundamentals of processing raw materials and industrials into finished goods. Describe a step-by-step material processing sequence. Explain industrial material processes. Explain the fabrication process and demonstrate how to do fabrication using a variety of tools, machines and techniques.
3. Design and build a heat formed plastic component. Analyze a heat formed plastic component to determine its physical strength and the characteristics of materials used in fabrication before and after the process.

Instructional Resources

Text reference: Meet the Mighty Mechanisms: Featuring Fischertechnik, Around the Bend: The Forming Process.* Supplemental reference: Capsula and LEGO equipment can be used to build models of transmissions. Lab 2000: Classroom Reference Manuals.

* Must have Smart Lab to do these components. Overall goal and concept will be revised once Smart Lab is installed.

Enrichment Activities

1. Build a model of a differential gear box which could be used on an aircraft.
2. Compare and contrast the power flow of transmission systems used in the automotive and aerospace industries.

Evaluation

Written, oral, demonstrations, drawings, presentations.

Unit 9 Presentation

Goal: Each team will use the computer to prepare a formal presentation of a project.

Timeline: 3 modules

Content/Concept

The computer is not only a resource or reference tool. It can be used to enhance a presentation (written, oral or graphic).

1. Computer designed animation.
2. Image digitizing and electronic printing.
3. Presentation design.
4. Electronic teleconferencing.*

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Use computer-animation software as a means of illustration.
2. Produce a bit-mapped reproduction of a 3-D object.
3. Generate a computer-aided desktop presentation of a completed team project using, at least, computer animation, technical drawings and image digitizing. Develop a video presentation to explain a technical device, process or project. Design modular display items to present work. Deliver an oral briefing to explain a technical device or process.
4. Use the teleconferencing system to jointly work on a project with another team, possibly from another school.

Instructional Resources

Text reference: Stepping Through Animation, An Image is Worth a Thousand Bits: Featuring MacVision. Supplemental reference: Student's notes and prior projects, Lab 2000: Classroom Reference Manuals.

* A modem and telephone connection are needed for this part of the unit.

Evaluation

Written, oral, demonstrations, drawings, presentations.

Unit 10 Writing/Publishing

Goal: The student will research information and write a report which could be presented to the class.

Timeline: 3 modules

Content/Concept

Writing is a basic fundamental skill which is used in all facets of life. The student must have knowledge of the history of technology as it relates to current communication modalities.

1. History of technology.
2. On-line database informational retrieval.
3. Electronic mail.
4. Desktop publishing.
5. Word processing.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Research historical information on important people, concepts and principles in aerospace technology and record the information. Write a report on the chosen topic which can be shared with classmates. Write a synopsis of the historical report, and attach it to a wall-mounted timeline chart.
2. Use database information obtained from an on-line databank resource for a report on technological advancements.
3. Use the electronic mail system to leave messages, instructions or data.
4. Compose a document that combines text and graphics.
5. Write and edit an original manuscript.

Instructional Resources

Text reference: Timeline: A Timetable of Technological Achievement, Processing Your Words: Featuring MacWrite, Making It Fit To Print: Featuring PageMaker. Supplemental reference: FAA on-line computer information sources, library books, magazines, Lab 2000: Classroom Reference Manuals.

Enrichment Activity

1. Create a story where a person uses advanced technology to live in space.

Evaluation

Written, oral, demonstrations, drawings, presentations.

Unit 11	Science
Goal:	The student will explore different aspects of science and the impact technology has on science.
Timeline:	6 modules

Content/Concept

Lab 2000 is designed to integrate different disciplines. The following science concepts can be taught through the use of the lab. Additionally, scientific principles have impacted the aerospace industry.

1. Hydroponic agriculture.
2. Photo transducer.
3. Thermistor.
4. Vibrations.
5. Noise.
6. Motion.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Design and build a greenhouse using the principles of hydroponics. Grow and harvest vegetables, herbs, flowers or other plants using the principles of hydroponics. Perform experiments varying the amount of light and temperature. Monitor and record the date and results from a hydroponics experiment.
2. Demonstrate how to use a photo transducer to monitor illumination levels. Record and chart illumination readings using a photo transducer interfaced with a computer. Interpret the data and make an assessment regarding levels of illumination using the data.
3. Demonstrate how to use a thermistor probe. Record and chart thermal readings using a thermistor probe interfaced with a

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Read and view information using laser disc media, compact disc and video.
2. Demonstrate professional behavior and perform job assignments within a video production team to aid in the coordination and enhancement of the overall production.
3. Develop a plan and script for a video sequence, including text, graphics and animation.
4. Plan, organize and produce a video related to the study of aerospace technology.
5. Cut and edit video sequences determining where dubbed sound, text, graphics and animation will be inserted.

Instructional Resources

Reference: Lab 2000: Classroom Reference Manuals.

* Must have Smart Lab in order to do this unit.

Evaluation

Written, oral, demonstrations, drawings, presentations.

AIR TRAFFIC CONTROL 1-2 (K120)

PHILOSOPHY: Each student should have a variety of experience in the aerospace industry. Air Traffic Control is a major component of the industry. Students should have the opportunity to explore air traffic control in depth.

INTRODUCTION: This course is a laboratory-oriented class preparing the student to operate in an air traffic control tower separating, sequencing and spacing aircraft.

PURPOSE: This course is intended to prepare the student for a career in air traffic control. The student will become aware of the demands of an air traffic controller and decide to continue in Air Traffic Control 3-4.

Unit 1 History of Air Traffic Control

Goal: The students will gain knowledge of the history of air traffic control and will be able to relate historical events to present day activities.

Timeline: 4 weeks

Content/Concept

1. Students must be knowledgeable of air traffic history to understand why and how the air traffic system works today.
2. Air traffic control is a relatively young discipline. Its impact on aviation has been dramatic.
3. If we are going to effectively articulate a need for aviation (including air traffic control) to grow we must understand the evolution of the air traffic control system.
4. The knowledge of the history of air traffic control will lay the foundation for the units to follow in the two courses.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Discuss the significance of the Air Mail Act of 1925.
2. Describe how the federal government became involved in air traffic control.
3. Discuss the history of the various federal agencies involved in air traffic control.
4. Discuss the formation of organized labor unions as they pertain to air traffic control.
5. Identify the organizations currently involved in the air traffic control system.
6. Identify the various organizations that have represented air traffic controllers.
7. Identify some of the methods air traffic controllers used in the past to separate aircraft.

Instructional Resources

Text reference: Nolan, Michael, Fundamentals of Air Traffic Control. Supplemental reference: video entitled, "It May Even Save Your Life," transparencies on history of air traffic control, numerous FAA/Department of Transportation publications and pamphlets.

Enrichment Activities

1. Students will tour air traffic control facilities.
2. Students will research one particular event in air traffic control history and report plus illustrate this event.
3. Students will construct a model aircraft.

Evaluation

1. Students will participate in daily writing exercises.
2. Weekly quizzes will be given consisting of objective-type questions.
3. Final exam will be essay questions.
4. Students will participate in a debate to examine their understanding of historical events.

Unit 2	Weather
Goal:	The students will learn the principles of weather and will demonstrate knowledge by completing the weather MF10C form.
Timeline:	4 weeks

Content/Concept

1. Receipt of weather information is vital to any aircraft flight.
2. Students must be knowledgeable of how weather is formed.
3. Students must be able to read weather reports.
4. The knowledge of weather will enable students to predict future weather to pass along to the pilot.
5. The student's ability to apply weather-related skills effectively is the most important factor in helping pilots avoid hazardous flight conditions.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Identify the parts of the atmosphere.
2. Recognize different clouds and the associated weather with these clouds.

3. Read and interpret weather instruments.
4. Identify and read parts of the weather report.
5. Apply weather knowledge to completing the weather report on Form MF10C.

Instructional Resources

Text reference: FM H-9, U.S. Weather Service. Supplemental reference: video on microbursts; Schaefer, Vincent J. and John D. Day, Atmosphere, Peterson Field Guide, Airman's Information Manual, Jeppesen-Sanderson - Weather.

Enrichment Activities

1. Visit Phoenix U.S. Weather station at Sky Harbor International Airport.
2. Take daily weather observations.

Evaluation

1. Students will take weekly quizzes.
2. Students will take daily observations and record on MF10C.
3. Weather observations will be broadcast to pilots and evaluated.

Unit 3	Navigation
Goal:	The student will learn basic navigational principles and demonstrate knowledge of navigation using various aeronautical charts.
Timeline:	4 weeks

Content/Concept

The function of an air traffic controller requires the knowledge of and application of principles pertaining to:

1. Enroute navigational aids.
2. Approach navigational aids.
3. Instrument approach charts.
4. Enroute navigation charts.
5. VFR sectional charts.
6. Precision and non-precision approaches.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Identify the enroute navigation aids in use today.
2. Identify the approach navigation aids in use today.
3. Briefly explain the operating principles behind navigational aids.
4. Properly interpret an instrument approach procedures chart.
5. Properly interpret an instrument enroute navigation chart.
6. Properly interpret a VFR sectional chart.
7. Determine whether an instrument approach procedure is a non-precision or a precision procedure.

Instructional Resources

Text reference: Nolan, Michael, Fundamentals of Air Traffic Control. Supplemental reference: Jeppesen-Sanderson video entitled, "Navigation," Airman's Information Manual, Clausing, Donald J. Aviator's Guide to Modern Navigation, airspace chart, aeronautical charts.

Enrichment Activity

Students will complete a cross-country navigation exercise using aeronautical charts.

Evaluation

1. Students will complete weekly quizzes.
2. Knowledge of navigation will be applied to a cross-country exercise.
3. Students will complete oral examination on their knowledge of aeronautical charts.

Unit 4	Airspace
Goal:	The students will gain knowledge of airspace and be able to apply procedures to a lab environment.
Timeline:	To Be Determined

Content/Concept

1. A complete understanding of airspace is a vital step in becoming an effective air traffic controller.
2. Airspace is a tool for air traffic control.
3. Airspace is the environment where the controller applies proper air traffic control procedures.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Discuss the need for airspace.
2. Describe the airspace structure.
3. Identify different types of airspace on the aeronautical charts.
4. Complete charts showing requirements in airspace.
5. Apply air traffic control procedures to different types of airspace.

Instructional Resources

Text reference: Nolan, Michael, Fundamentals of Air Traffic Control. Jeppesen-Sanderson video entitled, "Airspace," Airman's Information Manual.

Enrichment Activities

1. Field trip to planetarium.
2. Construct airspace model.
3. Orientation flights.

Evaluation

1. Students will complete weekly quizzes.
2. Students will complete an aeronautical chart/airspace exercise.
3. Oral quizzes will be given during orientation flights.

Unit 5 Communications

Goal: The students will learn proper radio procedures, the importance of proper phraseology and will apply the procedures in the control tower lab.

Timeline: 4 weeks

Content/Concept

1. A complete understanding and knowledge of the use of radio and interphones, the messages transmitted and relayed and the formats designed to preclude misunderstanding are the basis of a sound air traffic controller.
2. Professionalism of air traffic controllers is directly related to a controller's ability to apply proper radio procedures.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. State parts of air traffic control clearance.
2. State frequency bands used in the aviation community.
3. Distinguish between proper and improper phraseology.
4. State the proper phraseology for giving certain information to pilots.
5. Practice phraseology to aircraft in the VFR control tower.

Instructional Resources

Text reference: Nolan, Michael, Fundamentals of Air Traffic Control, Chapter 4. Supplemental reference: Jeppesen-Sanderson video entitled, "Communications," ATP 7110.65, video entitled, "Radio Communications for Pilots," cassette tapes and recorders.

Enrichment Activities

1. Students will make cassette tapes of proper phraseology.
2. Students will visit air traffic control facilities.
3. Students will listen to audio tapes of pilot/controller talk.

Evaluation

1. Weekly quizzes on communications.
2. Practical tests working air traffic control in lab.

3. Evaluation of proper phraseology using tapes.

Unit 6 Control Tower Procedures/Organization

Goal: Student will learn control tower procedures such as separation, sequencing and spacing, and will apply the procedure in the environment.

Timeline: 4 weeks

Content/Concept

1. The control tower is the key facility in the air traffic control system. It is here where air traffic control begins.
2. The students must learn how to sequence, space and separate aircraft in order to do their job in the tower.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Describe the function of a letter of agreement.
2. Describe the function of a facility directive.
3. Identify the responsibilities of a control tower operator.
4. Explain the purpose and operator of ATIS.
5. Define runway incursions.
6. Explain sequencing, separating and spacing and apply to given scenarios.
7. State arrival/departure separation minimum for airport traffic.
8. Explain wake turbulence.

Instructional Resources

Text reference: Nolan, Michael, Fundamentals of Air Traffic Control. Supplemental reference: video, ATC, communications, ATP 7110.65.

Enrichment Activity

Visit a control tower.

Enrichment Activities

1. Weekly quizzes.
2. Give correct responses to scenarios on overhead transparencies.

Unit 7	Control Tower Operation
Goal:	To enable students to practice procedures and phraseology in a simulated tower setting and evaluate performance against established criteria.
Timeline:	9 weeks

Content/Concept

The students have studied and learned air traffic control procedures for 27 weeks. This final unit of the first year in air traffic control will concentrate on performance. Students will work aircraft (other students using model airplanes) in the control tower/airport setting. The concept is to see if students can apply this knowledge and determine if they have the qualifications to be an air traffic controller.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Apply phraseology to aircraft in a simulated VFR tower environment.
2. Apply sequencing to aircraft in a simulated VFR tower environment.
3. Apply spacing to aircraft in a simulated VFR tower environment.
4. Apply separation to aircraft in a simulated VFR tower environment.
5. Apply procedures to aircraft in a simulated VFR tower environment.
6. Apply weather to aircraft in a simulated VFR tower environment.

Instructional Resources

Text reference: Nolan, Michael, Fundamentals of Air Traffic Control, Chapter 6. Supplemental reference: Airman's Information Manual, ATP 7110.65.

Note: No Enrichment Activities, Evaluation or Comments noted for this unit.

AEROSPACE 5-6 (K105)
"PRIVATE PILOT GROUND SCHOOL"

PHILOSOPHY: As an enhancement to the South Mountain High School Aerospace Program, we believe that each student should have the opportunity to experience flight through introductory and instructional airplane flight lessons. We also believe that many students would benefit from receiving instruction in airmanship, regardless of their ultimate career choices. Some students will choose only to make a few introductory, orientation-type flights, while others will continue on to receive the instruction necessary for solo flight. Still others, however, will have a strong desire to complete the flight training required to earn an FAA Private Pilots' License. The Private Pilot Ground School satisfies the entry requirements for those students wishing to solo or earn an FAA Private Pilots' License.

INTRODUCTION: This course is provided to assist those highly-motivated students in achieving their dreams of flight!

PURPOSE: This course will qualify the students to enroll in Aerospace Lab 1 (Flight Program) by completing the academic and medical prerequisites required by U.S. Federal Aviation Regulations, Part 61, Subpart A, Section 61.35 and Subpart D, Section 61.105. This course will include all of the areas of aeronautical knowledge prescribed by FAR 61.105, paragraph (a) and appropriate to "Private Pilot - Airplane" airman certification. Successfully completing this course will enable the student to receive an endorsement from an FAA certificated instructor authorizing that student to take the FAA Private Pilot Written Examination. A minimum competency of 70 percent is required to complete this course.

Unit 1	Basic Principles and Dynamics of Flight
Goal:	The student will comprehend the basic principles and dynamics of flight and relate the aircraft structure to these principles.
Timeline:	4 weeks

Content/Concept

This unit establishes the foundation for the entire course of training. The student will encounter many new concepts in the principles of flight including:

1. Airplanes and their components.
2. Aerodynamic principles related to the four forces of flight.
3. Basic aircraft stability and design features.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. List, match and describe the components of a single engine land aircraft. Explain how an aircraft and pilot are certified. Relate certification to single engine land aircraft.
2. List and explain the four principles of flight. Relate principles of flight to fundamental physical laws. Assess the effects of the four principles of flight on the performance of an airplane. List and describe the axes of flight and their respective control surfaces. Show how the principles of flight and the axes of flight relate and determine aircraft performance.
3. Define stability as it relates to flight. Describe the types of stability and explain the effect of stability on an airplane.

Instructional Resources

Text reference: Jeppesen-Sanderson, Aviation Fundamentals, 1989.
Supplemental reference: Jeppesen-Sanderson, Aviation Fundamentals Student Exercise Book, Chapter 1.

Enrichment Activities

1. Jeppesen-Sanderson videos.
2. FAA Aerodynamic videos.
3. Aircraft orientation.
4. Frasca 141 simulator.
5. ATC 610 simulator.

Evaluation

Daily/weekly quizzes, worksheets, student exercises, section quizzes, chapter tests.

Comments

Minimum competency required to complete this section is 70%.

Unit 2	The Flight Environment
Goal:	The student will comprehend the flight environment and understand how it effects the private pilot.
Timeline:	6 weeks

Content/Concept

The flight environment includes a broad range of information the student will need for any flight operation he/she may conduct. To safely operate an airplane in today's complex flight environment the student must understand and appreciate:

1. The importance of knowing and practicing safety of flight procedures.
2. The entire flight environment including aircraft operation on the ground and in the air.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Explain and practice collision avoidance techniques and procedures. Explain the right of way and minimum flight altitude regulations pertaining to flight. Select proper cruising altitudes and aircraft avoidance actions for a given flight.
2. Describe makeup of airports, identify airport markings and recognize and explain the meaning of segmented circles. Explain and practice the proper procedures for correcting for wing effects on the airplane. Explain the differences between controlled and uncontrolled airspace, identify specific airspace areas on a map and their specific flight requirements. State the visibility and cloud clearance requirements for VFR flight. Describe the differences between TCA's, ARSA, PCA and ATA's. Describe proper radio procedures and apply these procedures in simulated flight.

Relate the air traffic control radar environment to airspace used by a private pilot.

Instructional Resources

Text reference: Jeppesen-Sanderson, Aviation Fundamentals, 1989. **Supplemental reference:** Jeppesen-Sanderson Aviation Fundamentals Student Exercise Book, Chapter 2, U.S. Department of Commerce Sectional and Terminal Control Area Maps.

Enrichment Activities

1. Jeppesen-Sanderson videos.
2. FAA Aerodynamic videos.

Evaluation

Daily/weekly quizzes, worksheets, student exercises, section quizzes, chapter tests.

Comments

Minimum competency required to complete this section is 70%.

Unit 3	Aircraft Systems and Performance
Goal:	The student will comprehend aircraft systems and apply airplane performance factors to compute operating parameters.
Timeline:	6 weeks

Content/Concept

General aviation aircraft provide safe and reliable service under a variety of conditions. Their complexity is directly related to their size and performance. To operate safely the student pilot must:

1. Understand the aircraft systems which allow you to control and monitor performance.
2. Be able to calculate aircraft performance, such as take-off and landing distances when provided with the pertinent environmental factors.

Content/Concept

Weather is one of the most important factors that influence aircraft performance and flying safety. To operate an aircraft safely the student must:

1. Understand weather theory, patterns and hazards.
2. Be able to analyze and interpret weather data provided by the National Weather Service.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Explain basic weather theory and describe the global effects of weather patterns. Identify weather hazards and describe avoidance procedures.
2. Identify and differentiate between the different types of aviation weather reports, forecasts, maps and charts and describe the correct application of each. Accurately interpret and evaluate aviation weather reports, forecasts, maps and charts.

Instructional Resources

Text reference: Jeppesen-Sanderson, Aviation Fundamentals, 1989. Supplemental reference: Jeppesen-Sanderson, Aviation Fundamentals Student Exercise Book, Chapters 4, 5, Department of Transportation Aviation Weather and Aviation Weather Services.

Enrichment Activities

1. Jeppesen-Sanderson videos.
2. FAA Aerodynamic videos.
3. Visit FAA weather facility.

Evaluation

Daily/weekly quizzes, worksheets, student exercises, section quizzes, chapter tests.

Comments

Minimum competency required to complete this section is 70%.

Unit 5 Air Navigation

Goal: The student will comprehend and apply the principles of flight navigation.

Timeline: 8 weeks

Content/Concept

Air transportation from your home field to another destination requires you to comprehend and apply:

1. Basic navigation skills.
2. Radio systems to navigation.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Describe the global coordinate system. Identify the three basic types of VFR aeronautical charts. Differentiate between the three charts and describe the appropriate application of each. Accurately locate and interpret information presented on an aeronautical chart. Explain the operation of a manual (E-6B type) flight computer and correctly solve a variety of navigation problems. Define "pilotage" and "dead reckoning." Describe the process of dead reckoning. Demonstrate the correct use of a flight plotter. Develop an accurate and complete navigation log. Demonstrate the ability to request, organize, assimilate and interpret all information pertinent to a VFR flight.
2. Explain the functions and operation of the VOR navigation system. Explain the functions and operation of the ADF navigation system. Practice VOR/ADF in tracking and intercepts in simulator. Explain the functions and operation of advanced navigation systems, such as RNAV and LORAN.

Instructional Resources

Text reference: Jeppesen-Sanderson, Aviation Fundamentals, 1989.
Supplemental reference: Jeppesen-Sanderson, Aviation Fundamentals Student Exercise Book, Chapters 6, 7.

Enrichment Activities

1. Jeppesen-Sanderson videos.
2. FAA Aerodynamic videos.
3. Frasca 141 simulator.
4. ATC 610 simulator.

Evaluation

Daily/weekly quizzes, worksheets, student exercises, section quizzes, chapter tests.

Comments

Minimum competency required to complete this section is 70%.

Unit 6	Aviation Physiology
Goal:	The student will comprehend and appreciate the relationship between the human body and the flight environment, and will demonstrate a clear understanding of the importance of pilot attitudes, lifestyles and judgement to aviation safety.
Timeline:	1 week

Content/Concept

1. The student must understand and value the importance of aviation physiology. The pilot is the most important element in the airplane. just as you must understand the aircraft systems and equipment, you must have a working knowledge of aviation physiology.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Explain the hazards of visual illusions and describe avoidance procedures. Define "spatial disorientation" and describe its effects on the human body and the hazards that these pose to a pilot. Describe appropriate

avoidance/reduction techniques for spatial disorientation and motion sickness. Explain how atmospheric changes affect the human body and describe the potential flight hazards that may occur as a result of these changes. Explain how drugs, alcohol and cigarettes affect the human body and describe the flight hazards associated with each. Review oxygen requirements when flying at high altitudes (above 12,500 feet).

Instructional Resources

Text reference: Jeppesen-Sanderson, Aviation Fundamentals, 1989. Supplemental reference: Jeppesen-Sanderson, Aviation Fundamentals Student Exercise Book, Chapter 8.

Instructional Activities

1. Interview a police officer about how they use a field sobriety test to determine how a person is impaired. Then write, or give, a report on how the use of drugs and/or alcohol impairs a person's ability to perform their job.
2. Acquire a copy of an aerospace industry's rules and regulations regarding the use of alcohol, drugs and tobacco and write a report which summarizes it.
3. Write a report on how treatment occurs for people addicted to drugs, alcohol or tobacco.

Enrichment Activities

1. Jeppesen-Sanderson videos.
2. FAA Aerodynamic videos.
3. FAA spatial disorientation laboratory.

Evaluation

Daily/weekly quizzes, worksheets, student exercises, section quizzes, chapter tests.

Comments

Minimum competency required to complete this section is 70%.

Unit 7 Aviation Regulations

Goal: The student will understand aviation regulations and be able to apply them to private pilot flight operations.

Timeline: 1 week

Content/Concept

1. Federal Aviation Regulations (FAR's) define terms, outline airman requirements and set forth guidelines and restrictions necessary for safe flight. Incorporated with the FAR's are the National Transportation Safety Board rules which apply to the private pilot.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Define the terms and abbreviations most commonly used in the FAR's. Accurately interpret and apply those regulations contained in FAR Parts 61 and 91, and NTSB Part 830 that specifically relates to private pilot flight operations.

Instructional Resources

Text reference: Jeppesen-Sanderson, Federal Air Regulation/Airman Information Manual, Part 61, 91, NTSB Part 830.

Evaluation

Quizzes, open book test.

Comments

Minimum competency required to complete this section is 70%.

Unit 8 Test Preparation and Review

Goal: The student will be familiar with the format of the FAA's Private Pilot Written Exam and will practice effective test-taking techniques and pre-testing stress reduction strategies.

Timeline: 3 weeks

Content/Concept

1. To prepare for the FAA written examination the student will complete a course review and diagnostic evaluation. Then he/she will complete multiple practice examinations. After each evaluation, the student will receive instructions on weak subject areas and correct to 100 percent. Unit will terminate with the administration of the FAA test.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Review subject areas in units 1-7. Practice effective test-taking techniques and pre-testing stress reduction strategies. Describe the format and style of questioning used by the FAA on the Private Pilot Written Examination. Practice taking at least two FAA-style written examinations. Review any areas of aeronautical knowledge in which the student's performance is weak or marginal and receive individual instruction when necessary. Take an FAA Private Pilot Written Examination administered by a designated FAA examiner.

Instructional Resources

Text reference: Jeppesen-Sanderson, Aviation Fundamentals, 1989. Supplemental reference: King Private Pilot videos, Jeppesen-Sanderson, Federal Air Regulation/Airman's Information Manual.

Enrichment Activities

1. Videos - King Private Pilot Test Review.

Evaluation

Diagnostic test, practice test, FAA written exam.

Comments

Minimum competency required to complete preparation and qualify to take the FAA Private Pilot Written Examination is 80%.

Unit 9	Intermediate Airmanship
Goal:	The student will synthesize previous knowledge and assess skills while acquiring advanced knowledge in decision making, flight planning and aircraft operations.
Timeline:	2 weeks

Content/Concept

Up to this point, all instruction has focused on acquiring the aeronautical knowledge necessary to successfully complete the FAA written examination. To prepare for actual flight students will expand their knowledge base in the following areas:

1. Flight planning and decision making.
2. Accident prevention.
3. The Airman's Information Manual.
4. Characteristics of high performance aircraft.
5. Fundamentals of instrument flight.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Plan and organize a complex VFR flight. Explain the decision-making process and describe the factors that influence it. Recognize and assess risk factors and pilot stress factors that may adversely affect a flight. Implement effective strategies to reduce risk factors and pilot stress factors.

2. Identify the most common causes of aircraft accidents. Implement effective accident prevention strategies. Utilize accident prevention resources available to pilots.
3. Obtain and apply information contained in the Airman's Information Manual to develop a flight plan and conduct a safe flight.
4. Explain the systems and performance considerations of complex and high-performance aircraft. Describe accepted procedures for transitioning into a larger, more complex, and/or higher performance airplane.
5. Practice on the simulator the fundamentals of instrument flight.

Instructional Resources

Text reference: Jeppesen-Sanderson, Aviation Fundamentals, 1989 and Instrument Rating Fundamentals.

Enrichment Activities

1. FAA videos.
2. Simulator.
3. Visit corporate flight center.

Evaluation

Diagnostic test, practice test.

Comments

Course is primarily self-directed with guidance provided by CFI instructor. Student will progress at his/her own rate. No minimum competence required.

AIR TRAFFIC CONTROL 3-4 (K122)

PHILOSOPHY: Each student should have a variety of experience in the aerospace industry. Air traffic control is a major component of the industry. Students should have the opportunity to explore air traffic control in depth.

INTRODUCTION: This course is laboratory-oriented, preparing the student to operate in a radar air traffic control facility.

PURPOSE: This course is intended to prepare the student for a career in air traffic control. The student will become aware of the demands of an air traffic controller and decide to continue their education and requirements to be an air traffic controller.

Unit 1 Non-Radar Procedures

Goal: Students will learn non-radar procedures. These procedures are necessary in the event radar fails or is not available. Students will apply these procedures to a simulated approach control problem.

Timeline: 9 weeks

Content/Concept

1. Radar equipment is susceptible to failure. In this event controller must revert to non-radar procedures.
2. Air traffic controllers must ensure a block of airspace for aircraft operating on instrument flight plan procedures.
3. Students will study separation criteria and tools to keep aircraft separated under non-radar procedures.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. State the four methods of non-radar separation.
2. Define the dimensions of the area generally assigned to each airport.
3. Describe how non-radar separation is applied to aircraft.
4. Apply knowledge of strip marking to a simulated non-radar approach control problem.
5. Know holding pattern procedures.

Instructional Resources

Text reference: Nolan, Michael, Fundamentals of Air Traffic Control, Chapter 7. Supplemental reference: ATP 7110.65, Airman's Information Manual.

Enrichment Activities

1. Visit TRACON and airport traffic control center.

Evaluation

Daily evaluation check will be made using flight progress strips and a flight progress board. Weekly quizzes will be given.

Unit 2	Radar Operation
Goal:	Students will learn the theory and operation of radar. They will learn radar procedures and apply these procedures in running computer software called TRACON.
Timeline:	9 weeks

Content/Concept

1. Radar is the primary instrument used by controllers to separate aircraft.
2. Radar has significantly enhanced the ability of controllers to provide an efficient and safe environment.
3. Controllers must understand how radar works to effectively use the equipment.
4. Radar provides for a dynamic air traffic control environment. Students must have a thorough knowledge of procedures and how to apply these procedures.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Describe operation of a radar system.
2. Describe differences between primary and secondary radar.
3. Describe the automated radar terminal system.
4. Identify the methods of radar identification.
5. Explain radar hand-off procedures.
6. Explain methods of separating aircraft using radar.
7. Understand vectoring techniques.
8. Apply vectoring to computer program.
9. Demonstrate knowledge of radar procedures to computer program TRACON.

Instructional Resources

Text reference: Nolan, Michael, Fundamentals of Air Traffic Control, Chapters 8 and 9. Supplemental reference: ATP 7110.65, Airman's Information Manual, video entitled, "Radar Contact."

Enrichment Activities

1. Students will visit radar facilities.

Evaluation

Weekly quizzes, daily evaluation of computer performance both by computer and instructor.

Unit 3	National Airspace System and Flight Service
Goal:	**Students will gain a complete understanding of the National Airspace System and be able to track aircraft throughout the system. Student will gain knowledge of Flight Service Station procedures and use these procedures in real time situations.**
Timeline:	9 weeks

Content/Concept

1. Students need to have an understanding of the entire National Airspace System and to visualize the relationship air traffic control has in that system.
2. Students will study the flow of information by taking aircraft on simulated flights throughout the system.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Describe the flow of flight plan information through the air traffic control system.
2. Describe the operation of the flight data processing system.
3. Describe function of the central flow control facility.
4. Understand the procedure used to assist lost or overdue aircraft.

5. Explain the uses of enroute flight advisory service.

Instructional Resources

Text reference: Nolan, Michael, Fundamentals of Air Traffic Control, Chapters 10 and 12. Supplemental reference: Airman's Information Manual, Capital Investment Plan, video entitled, "Central Flow Control - National Airspace System."

Enrichment Activities

1. Students will take a field trip to Prescott.

Evaluation

Weekly quizzes.

Unit 4	Control Tower Examination - Employment in Air Traffic Control
Goal:	Students will successfully pass the FAA Control Tower Operator Examination and gain knowledge of how to get a job in air traffic control.
Timeline:	9 weeks

Content/Concept

1. Each student desiring to be an air traffic controller must complete a written seven-part control tower operator examination.
2. Students will use the CTO study guide to prepare them to take the test.
3. Students will explore the different avenues to enter air traffic control and plot this path.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Complete and pass with a minimum score of 70% the control tower operator exam.

2. Explain the job opportunities in air traffic control and how to get hired.

Instructional Resources

Text reference: Nolan, Michael, Fundamentals of Air Traffic Control, Chapter 13. Supplemental reference: Control Tower Operator (CTO) Study Guide, TS-14-1.

Enrichment Activities

1. Students will take a field trip to air traffic control facilities.
2. Guest speakers on job opportunities.

Evaluation

Weekly quizzes, Control Tower Operators' examination.

AEROSPACE LAB (K103)

PHILOSOPHY: The South Mountain High School Aerospace Program believes that each student who successfully completes the academic and medical requirements for an FAA private pilot's license be allowed to attempt to complete the flight and ground training required to earn an FAA private pilot's license.

INTRODUCTION: This course is provided to assist those highly motivated students in achieving their dreams of flight!

PURPOSE: Aerospace Lab 1-2 provides the ground, simulator and flight training required to qualify the student pilot for FAA private pilot certification evaluation in a single engine land airplane in accordance with FAR Part 61.109 and the FAA Practical Test Standards. Successfully completing this course of training and the evaluation will result in the student receiving his/her private pilot's license.

Enrichment Activities

1. Take-off and landing video.
2. FAA airport environment/airspace.
3. Visit fixed-base operator for orientation.

Evaluation

Quizzes, tests, simulator evaluation.

Comments

Requires 70% competency upgraded to 100%. This unit of instruction must be complete to above standards before student can enter into Unit 2.

Unit 2	Pre-Solo Phase
Goal:	The student will fly solo in a single engine land airplane.
Timeline:	10 weeks

Content/Concept

In this unit the student will apply previous skills and training and will practice, in the airplane and the simulator, the following areas:

1. Pre-flight operations.
2. Ground operations.
3. Take-off and landings.
4. Airport and traffic pattern procedures.
5. Flight maneuvers.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Demonstrate proper airplane pre-flight and identify critical areas/limitations. Name the required documents required for flight.

2. Start engines and taxi airplane as directed by ground control to proper runway. Identify and explain emergency light signals.
3. Take-off and land airplane using proper operating procedures and control procedures.
4. Explain proper airport and traffic pattern procedures and demonstrate proficiency in simulator and in flight. Demonstrate pattern entry and exit procedures in flight and in simulator.
5. Practice and demonstrate proficiency in flight at critically slow airspeeds. Practice and demonstrate proficiency in flight maneuvering by reference to ground objects including rectangular course, S-turns across a road, and turns around a point. Practice simulated airplane emergencies in the simulator and in flight.

Instructional Resources

Text reference: Jeppesen-Sanderson, Aviation Fundamentals, 1989. Supplemental reference: FAA FTHB, Chapters 6 - 11, Pilot's Operating Handbook, Magnet School Syllabus Lessons 6-14.

Enrichment Activities

1. Jeppesen-Sanderson videos.
2. Actual flying.
3. Simulator training.

Evaluation

Simulator evaluation, tests, in-flight stage checks.

Comments

Successful completion of this unit is required prior to entering Unit 3. Academic and in-flight competencies must be maintained at a 70% or higher level to proceed.

Unit 3	Solo/Advanced Instruction Phase
Goal:	The student will practice take-offs and landings and in-flight maneuvers and practice airplane maneuvers, solo and dual, to meet Practical Test Standards.
Timeline:	10 weeks

Content/Concept

Having completed an initial evaluation the student pilot will advance to the solo/advanced instruction phase. To complete this phase of training the student will practice, both solo and dual, the following areas:

1. Solo/dual take-offs, landings and previous maneuvers.
2. Advanced maneuvers.
3. Night flight operations.
4. VOR/ADF navigation.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Practice and maintain proficiency in all previous ground and flight maneuvers. Practice solo take-off and landings. Practice solo in-flight maneuvers to include stalls, MCA, ground reference maneuvers.
2. Practice and demonstrate proficiency in short field and soft field landings, in flight by reference to instruments, in analyzing and correcting for simulated in-flight emergencies.
3. Practice and demonstrate airplane proficiency at night including ground operations, enroute navigation, takeoffs and landings for a minimum of three flight hours.
4. Practice and demonstrate VOR/ADF navigation and course/bearing intercepts. Practice navigating to/from airport using ADF/VOR navigation aids. Fly at least ten (10) hours solo in preparation for FAA evaluation and make a minimum of three (3) landings to a full stop at a controlled airport.

Instructional Resources

Text reference: Jeppesen-Sanderson, Aviation Fundamentals.
Supplemental reference: FAA FTHB, Chapters 7 - 11 and 14, Pilot's Operating Handbook, Magnet School Syllabus Lessons 15, 16, Review Lessons 6-14.

Enrichment Activities

1. Jeppesen-Sanderson videos.
2. Simulator training.

Evaluation

Simulator evaluation, tests, in-flight stage checks.

Comments

Completing Unit 3 allows the student to enter the cross country phase of instruction. A minimum competency of 70% must be maintained.

Unit 4 Cross Country Phase

Goal: The student will demonstrate proficiency in cross country navigation meeting all FAR and Practical Test Standards (PTS) standards.

Timeline: 8 weeks

Content/Concept

1. The student will receive dual instruction in cross country planning and actual cross country navigation and, when found proficient, will plan and fly solo a minimum of three cross country navigation flights.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Flight plan a minimum of thirteen (13) hours of cross country flight.
2. Fly with an instructor or pilot for a minimum of three (3) hours of cross country.
3. Fly a minimum often (10) hours solo cross country and fulfill all FAR Part 61.109 requirements.
4. Practice VOR/ADF navigation on the simulator to include course/bearing intercepts.
5. Demonstrate proficiency in all forms of navigation, pilotage, dead reckoning and radio-aided navigation.

Instructional Resources

Text reference: Jeppesen-Sanderson, Aviation Fundamentals, 1989. **Supplemental reference:** FAA FTHB, Chapter 12, Pilot's Operating Handbook, Magnet School Syllabus, Lessons 17-19.

Enrichment Activities

1. Jeppesen-Sanderson videos.
2. Simulator training.

Evaluation

Simulator evaluation, tests, stage checks.

Comments

Completing Unit 4 qualifies the student to enter the evaluation preparation phase for his FAA in-flight evaluation IAW PTS (Practical Test Standards).

Unit 5	PTS Evaluation Preparation
Goal:	The student will demonstrate competency in all items required by FAR 61.109 and FAA Practical Test Standards.
Timeline:	3 weeks

Content/Concept

During this phase of instruction the student will practice all flight maneuvers and review aviation knowledge to ensure proficiency and competency in all areas evaluated during an FAA private pilot evaluation. To accomplish this, the following areas must be reviewed:

1. FAR 61.109.
2. FAA - Practical Test Standards (PTS).
3. Airspace, FAR's, systems and PTS general knowledge.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Ensure that all FAR Part 61.109 requirements have been fulfilled.
2. Demonstrate flight competency in all areas covered under the FAA Practical Test Standards for single engine land aircraft.
3. Demonstrate academic competency in FAR's, airspace requirements, aircraft systems and FAA PTS.

Instructional Resources

Text reference: Jeppesen-Sanderson: Aviation Fundamentals, 1989. Supplemental reference: FAA FTHB - Chapters 1-14, Review, Pilot's Operating Handbook, Magnet School Syllabus - Lesson 20, DOT - Sectional and Terminal Control Area Maps.

Enrichment Activities

1. Jeppesen-Sanderson videos.
2. Flight Evaluation video.
3. Simulator training.

Evaluation

Stage checks, oral evaluation, FAA In-Flight Evaluation for Single Engine Airplane IAW, Practical Test Standards.

Comments

This unit of instruction fine tunes the student's skills for his/her FAA inflight evaluation. Successfully completing this phase will award the student a single engine land private pilot certification (a pilot's license).

Unit 6	Post Graduate - Instrument
Goal:	The student will comprehend fundamentals of instrument flight and practice instrument flying.
Timeline:	1-5 weeks

Content/Concept

To enhance pilot proficiency, students who receive their single engine private pilot certificate will have the opportunity to continue instrument training. This training will incorporate academic instruction and actual instrument flying using the Frasca 141 instrument simulator. The course of instruction will cover the following areas:

1. FAR requirements for an instrument rating.
2. Fundamentals of instrument flight and practices.
3. Holding and instrument-approach procedures and practices.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Summarize the FAR requirements for an instrument rating.
2. Explain the command/performance approach to instrument flight. Practice the command/performance approach to instrument flight on the simulator (basic instruments).
3. State the FAR and AIM requirements and guidelines for instrument holding and instrument approaches. Practice instrument holding and approaches on the simulator.

Instructional Resources

Text reference: Jeppesen-Sanderson, Instrument Rating Manual.
Supplemental reference: FAA Instrument Flying Handbook.

Enrichment Activities

1. Simulator.
2. Videos.

Evaluation

Oral exams, practice tests.

Comments

This unit of instruction is available to those students who complete their private pilot training and receive their private pilot certification. Further, this course is primarily a self-directed course with course study presented by resident CFII instructor. Students motivated to continue to advance to an instrument rating can credit up to 20 hours of simulated instrument flying time toward this rating IAW FAR's.

HUMAN RELATIONS IN THE AVIATION INDUSTRY (H110)

PHILOSOPHY: It is our belief that the aerospace program must prepare students not only with the entry level technical skills desired in aerospace industries but also with the human relation skills necessary to be successful in the workplace.

INTRODUCTION: This course will help students to develop skills in self-understanding, interpersonal relations in the workplace, communicating, problem solving, working as a team member, dealing with change and managing resources.

PURPOSE: To enhance the employability of our aerospace students by preparing them with the human relations skills necessary to be successful in a work environment.

Unit 1	Understanding One's Self
Goal:	Understand factors that contribute to self-development and self-acceptance.
Timeline:	To be determined

Content/Concept

1. One has a better chance of understanding and getting along with other people if one understands self. An understanding of how inheritance, environment and past experiences have contributed to a person's development may help one to understand self.
2. Understanding that everyone has the same basic needs and that satisfying those needs is a basic reason for behavior, may help one understand self and others.
3. Values influence what is important to one and may change over time.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Describe how heredity, environment and experiences contribute to one's development.
2. Identify the basic human needs.
3. Explain how values are formed and changed. Identify personal values.

4. Explain how attitudes develop and change. Describe how the attitudes of one person can affect the attitudes of co-workers.
5. Describe the components of self concept. Describe strategies for building self confidence.
6. Analyze how one's values, attitudes and self concepts influence one's behavior. Analyze one's behavior to determine positive and negative behaviors.

Instructional Resources

Text reference: Steven Eggland and John Williams, Human Relations at Work, pp 14-63, George Shinn, Leadership Development, 1986, pp 2-4, Patsy Fulton, Exploring Human Relations, pp 26-46, Harold Wallace and L. Ann Masters, Personality Development for Work, pp 12-35.

Unit 2	Desirable Employee Attributes
Goal:	The student will have an understanding of personal attributes desired by an employer and how one's own attributes compare to those desired by employers.
Timeline:	To be determined

Content/Concept

1. One's personal qualities impact their success on the job.
2. Employers usually know what skills, abilities and traits they want from employees.
3. Employees who are willing to be evaluated and to make improvements are more likely to succeed.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. List own qualities. Analyze own qualities for strengths/refinements.
2. Describe qualities desired by employers. Compare one's own qualities to those desired by employers.
3. Identify the steps in an improvement plan. Complete a plan to address one area of needed improvement.

Instructional Resources

Text reference: George Shinn, Leadership Development, 1986, Chapter 4, pp 23-26, Patsy Fulton, Exploring Human Relations, pp 148-153, Harold Wallace and L. Ann Masters, Personality Development for Work, pp 52-63.

Unit 3	Getting A Job
Goal:	The student will understand how to search for a job, apply for a job and secure a desired job.
Timeline:	To be determined

Content/Concept

1. Looking for a job that matches aptitudes, interests and preferences focuses the job search and improves the chances of job satisfaction when a job is secured.
2. Exploring many sources for finding a job increases the chances of getting a job.
3. Resumes give employers important information about the applicant and create a first impression about the applicant.
4. Employers seek specific information about applicants on job applications and evaluate the written information for completeness and appearance to determine who will be interviewed.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Describe jobs that match one's personal aptitudes, interests and preferences.
2. Investigate sources for finding a job.
3. Prepare a resume.
4. Practice filling out job applications.
5. Demonstrate job interview skills.

Unit 4	Salary & Benefit Packages
Goal:	The student will understand salary and benefit packages.
Timeline:	To be determined

Content/Concept

1. Salary and the opportunities for advancement are important factors when considering a job offer.
2. In order to meet their own insurance needs, employees need to understand the types, kinds of coverage and costs of insurance offered by employers.
3. Companies offer a wide range of benefits in addition to insurance which may include paid vacations, retirement plans, overtime, professional development opportunities, childcare, health club memberships, etc.
4. When deciding to accept a job or resign from a job, the gain or loss of salary and benefits should be considered together.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Define terms related to salary. Describe various salary packages from aerospace employers. Compare salary packages offered by two aerospace employers.
2. Define terms related to insurance. Describe types of health insurance and kinds of coverage and costs. List other types of insurance offered by employers. Compare insurance packages offered by two aerospace employers.
3. List benefits other than insurance offered by employers.
4. Analyze salary and benefit packages offered by two aerospace companies.

Instructional Resources

Reference: salary and benefit packages from aerospace employers.

Unit 5	Effective Communication Skills in a Business Setting
Goal:	The student will know effective communication skills for a business setting.
Timeline:	To be determined

Content/Concept

1. Good communication skills are a must in the world of work. It is impossible to work without communicating with others.
2. Many human relations problems that occur on the job result from people's inability to communicate effectively with each other.
3. In order for an employee to be successful he/she should understand the formal and informal communication system of the organization.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Define communication terms. Describe the communication process. Identify and demonstrate effective listening skills. Describe non-verbal communication skills. Demonstrate appropriate non-verbal communication skills. Identify levels of communication. Categorize examples of communication into the appropriate level of communication.
2. Describe communication blocks. Analyze own communication to determine use of communication blocks.
3. Describe formal and informal business communication.

Instructional Resources

Text reference: George Shinn, Leadership Development, 1986, Chapter 10, pp 90-94, Patsy Fulton, Exploring Human Relations, pp 58-82 and pp. 86-92, Harold Wallace and L. Ann Masters, Personality Development for Work, pp 158-194.

Unit 6	Appropriate Employee Appearance and Behavior in Business Environments
Goal:	The student will have an understanding of appropriate employee appearance and behavior in business environments.
Timeline:	To be determined

Content/Concept

1. It is a person's clothes and the way one dresses that creates a first impression and tells other people whether or not he/she is serious about getting ahead in the world.
2. The business dress code is conservative and formal. Following the dress code enables one to fit in and to look like a team member.
3. An employee's personal appearance and behavior on the job is a reflection of the employee and the employer/company.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Describe steps in good personal grooming. List signs of quality clothes. Identify characteristics of clothes that fit properly. Describe a basic business wardrobe. Select clothing choices that would enhance your body type and coloring. Demonstrate basic care of clothes.
2. Describe basic rules for business dressing.
3. Describe basic business etiquette.

Instructional Resources

Text reference: George Shinn, Leadership Development, Chapter 7, pp. 57-71.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Describe the steps in the decision-making process. Apply the decision-making process to work-related situations.

Instructional Resources

Text reference: Patsy J. Fulton, Exploring Human Relations, pp. 153-156.

Unit 9 Creative Problem Solving

Goal: The student will have an understanding of creative problem solving.

Timeline: To be determined

Content/Concept

1. Creativity is a trait everyone possesses and it can be developed.
2. Creativity - from coming up with new ideas to selling them to other people - is important to one's success as an employee and as an employer.
3. Creative problem solving is a critical skill in the workplace.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Describe ways to increase one's creativity. Participate in activities to develop creative abilities.
2. Discuss why creativity is important to employees' and employers' success.
3. List the steps used in problem-solving. Demonstrate the ability to use problem-solving steps to address business problems.

Instructional Resources

Text reference: George Shinn, Leadership Development, pp. 152-161.

Unit 10 Getting Along With Supervisors

Goal: The student will understand effective interpersonal relations with supervisors.

Timeline: To be determined

Content/Concept

1. No matter how good an employee is at the job, one's chances for job success and promotion are reduced if a positive working relationship cannot be established with the supervisor.
2. Understanding a supervisor's management style can help an employee develop a good working relationship with his/her supervisor.
3. Evaluations of employees' work are used to promote, retain and terminate employees. Being familiar with the evaluation forms and procedures can help an employee understand what the supervisor expects.
4. Constructive criticism from a supervisor can help an employee improve on the job, and improved skills can lead to additional self-confidence and promotions.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Explain the importance of a positive working relationship between employee and supervisor. Describe employee behaviors that contribute to a positive working relationship with an employer.
2. Define and describe each management style, identify management style of supervisors/employers described in case studies. Demonstrate the ability to work with different management styles.
3. Identify the criteria and procedures described in the evaluation documents of several aerospace businesses that are used to evaluate employees.

4. Demonstrate the ability to seek, accept and handle criticism.

Instructional Resources

Text reference: Steven Eggland and John Williams, Human Relations at Work, pp 94-102, George Shinn, Leadership Development, 1986, pp 14-20, Patsy Fulton, Exploring Human Relations, pp 157-158, Harold Wallace and L. Ann Masters, Personality Development for Work, pp 94-111.

Unit 11	Getting Along With Co-Workers
Goal:	The student will understand how to get along with co-workers.
Timeline:	To be determined

Content/Concept

1. Many research studies show that one's ability to succeed in the workplace depends on how well one gets along with co-workers.
2. On the job, getting the work done is a team effort.
3. Employees who get along well with co-workers have a better work environment and are less likely to leave the job than employees who do not.
4. Learning ways to increase one's tolerance for the personality differences of co-workers improves one's chances for success on the job.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Describe the personality traits conducive to working with others.
2. Explain the importance of being a team player. Identify rules for working successfully in groups.
3. Demonstrate the ability to work successfully in groups.
4. Describe ways to increase tolerance for personality differences of co-workers.

Instructional Resources

Text reference: Steven Eggland and John Williams, Human Relations at Work, pp 64-85, George Shinn, Leadership Development, 1986, pp 20-22, Patsy Fulton, Exploring Human Relations, pp 100-104, Harold Wallace and L. Ann Masters, Personality Development for Work, pp 77-93.

Unit 12 Getting Along With Customers

Goal: The student will understand the importance of a positive relationship with customers.

Timeline: To be determined

Content/Concept

1. The reputation of a company is based at least as much on courtesy, thoughtfulness, kindness and competence of the people operating the company as it is based on the quality of goods or services that the company sells.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Explain reasons why customers do business with companies. List guidelines on how to deal with customers. Explain "the customer is always right" and "it's business, not personal." Practice effective ways to deal with customers.

Instructional Resources

Text reference: Steven A. Eggland and John W. Williams, Human Relations at Work, pp. 104-121.

BEST COPY AVAILABLE

Unit 13	Coping With Conflict in the Workplace
Goal:	The student will understand how to cope with conflict in the workplace.
Timeline:	To be determined

Content/Concept

1. Understanding conflict and developing skills to cope with it are critical to one's success in the work environment.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Define terms, describe reasons for conflict, identify the stages of conflict. Explain the attitudes one must possess to resolve conflicts. Describe the problem solving method of resolving conflict. Demonstrate positive and negative ways of dealing with conflict.

Instructional Resources

Text reference: Harold Wallace and L. Ann Masters, Personality Development for Work, pp. 112-127.

Unit 14	Planning, Organizing & Time Management Skills
Goal:	The student will understand planning, organizing and time management skills.
Timeline:	To be determined

Content/Concept

1. One's success on the job will depend to a great extent upon one's ability to demonstrate skills in planning, organizing and time management.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Explain and demonstrate procedures for organizing one's work. Describe ways to be efficient and effective at one's work. Describe time management techniques. Analyze how one spends time.

Instructional Resources

Text reference: Harold Wallace and L. Ann Masters, Personality Development for Work, pp. 64-76, George Shinn, Leadership Development, pp. 196-202.

Unit 15	Environmental/Cultural Aspects of the Workplace
Goal:	The student will have an understanding of the environmental/cultural aspects of the workplace.
Timeline:	To be determined

Content/Concept

1. Almost every organization has a style - a way of working and thinking that influences every decision that is made in the company.
2. An employee is usually best off in a company whose style and philosophy are like their own.
3. In both business and personal situations, conflicts may occur because people have differences in their perceptions of what constitutes ethical behavior.
4. Office politics exist in all organizations and can influence employees careers.
5. There are laws and governmental agencies to deal with job related discrimination, sexual harassment and safety.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Define terms.
2. List examples of the "culture of a business."
3. Explain business ethics. List questions to ask self when faced with an ethical problem.

4. Describe examples of office politics. Explain guidelines for dealing with office politics.
5. Describe the basic components of the Equal Employment Opportunity Act. Explain how to differentiate between excessive friendliness and sexual harassment. Describe choices an employee has if he/she is sexually harassed on the job. Explain the purposes of the Occupational Safety and Health Act and The Environmental Protection Act.

Instructional Resources

Text reference: George Shinn, Leadership Development, pp. 223-227, Grady Kimbal and Ben Vineyard, Succeeding in the World of Work, pp. 133-145, Harold R. Wallace and L. Ann Masters, Personality Development for Work, pp. 143-157.

Unit 16	Impact of Changes in Technology and Social Structure
Goal:	The student will analyze the impact of changes in technology and social structure on business and industry and on employers and employees.
Timeline:	To be determined

Content/Concept

1. More changes have taken place in the workplace in the last ten years than in the previous 100 years. These changes have affected our workplaces, our homes and our personal lives.
2. The future holds the possibility of improvements and the possibility of risks associated with rapid change.
3. Understanding change and preparing for change helps employers and employees cope more effectively with change.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Describe changes in technology and social structure in the last 25 years.
2. Identify problems that occur as a result of change. Investigate the effects of change on people's lives.

3. Analyze methods of coping with change. Describe steps employees take to prepare for changing jobs/careers.

Instructional Resources
Text reference: Patsy J. Fulton, Exploring Human Relations, pp. 117-138.

Unit 17 Management Styles

Goal: Demonstrate the ability to work with different management styles.

Timeline: To be determined

Content/Concept

1. Understanding an employer's management style can help an employee develop a good working relationship with his/her employer.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Define management style.
2. Describe each management style.
3. Identify management style of managers/employers described in case studies.
4. Demonstrate the ability to work with different management styles.

Instructional Resources

Text reference: Steven Eggland and John W. Williams, Human Relations at Work, pp. 94-102.

AEROSPACE MARKETING

PHILOSOPHY: We recognize the immense importance of aerospace to the rapidly changing world around us. As citizens of the leading aerospace nation on earth, it is vital that we assume certain responsibilities and obligations in order to make informed decisions.

INTRODUCTION: This course will cover the fundamentals of marketing, business organization and management as they relate to the starting and ongoing operations of a small business in the aerospace industry.

PURPOSE: This course is intended to make the students aware of the many aspects of the successful operation of an aerospace company.

Unit 1	Getting Started in a Small Aerospace Business
Goal:	Students will determine what a small business is, characteristics of successful businesses, and the importance of detailed business planning.
Timeline:	2 weeks

Content/Concept

1. The successful operation of a business is dependent upon the owner's knowledge of successful business strategies and practices. Without such knowledge, a business is rarely successful.
2. An entrepreneur is the backbone of the general aviation business. It is through his/her efforts that thousands of jobs in the industry are created. to be successful, an entrepreneur must have the skills of business planning.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Discuss what an entrepreneur is and the characteristics which make a successful entrepreneur.
2. Formulate a business plan for a small business at a local airport. Identify various sources of assistance for a person beginning a new business.

Instructional Resources

Text reference: Entrepreneurship, Chapters 1, 2. Supplemental reference: Small Business Administration pamphlets and newspaper articles regarding business failures.

Enrichment Activities

1. Read magazine articles about successful fixed base operations and write a report on their methods for beginning operations.
2. Have a commercial loan officer from a major bank visit the class and talk about the importance of planning to the successful operation of a business, new or existing.

Evaluation

Written tests, preparation of a business plan outline, written report.

Unit 2	Marketing the Small Business
Goal:	Students will be able to define marketing and describe how the 4 P's of marketing interact with each other and the basic business plan from Unit 1.
Timeline:	3 weeks

Content/Concept

1. Marketing is the cornerstone upon which businesses and our economy thrive. Fifty percent of the jobs in Arizona, and almost all aviation-related jobs are marketing related.
2. To properly market products, a businessman must be able to pick a segment of the market to target. Once the market is targeted, the 4 P's of marketing can be introduced to plan a more specific marketing and business plan.
3. The knowledge of product pricing is also vital to any business. Without the knowledge of proper and reasonable pricing, few businesses can survive. Price too low and the company is not in business long; price too high and customers will go elsewhere.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Describe the interaction of each of the 4 P's of marketing.

2. Develop a marketing plan for a given segment of the aerospace industry. Explain the importance of analyzing competitive strengths and weaknesses.
3. Determine a profitable pricing structure for a given aerospace product or service. Calculate product pricing through mark-up, mark-down based on cost and retail prices.

Instructional Resources

Text reference: Entrepreneurship, Chapters 3,4,6 and 7.
Supplemental reference: video on industrial marketing.

Enrichment Activities

1. View video on industrial marketing of a new jet trainer.
2. Through magazines and visits to local fixed base operations (FBO's), determine possible pricing combinations for a variety of aviation products.

Evaluation

Written tests and oral presentations of proposed pricing structures. Written report on the interaction of the 4 P's and market segmentation and research.

Unit 3	Selling
Goal:	Students will demonstrate proficiency in selling a variety of aviation-related services and products.
Timeline:	2 weeks

Content/Concept

1. To be able to sell in today's competitive environment, salespeople must be able to know their product's features and the benefits those features give to customers.
2. In order to communicate these features and benefits to customers, a salesperson needs to be able to plan a pre-approach, approach, presentation, close and follow-up with the customer. Without these steps a sale is not closed.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Determine what the features of a product are. Determine how the product features become product benefits useful in the closing of a sale.
2. Evaluate various available customer approaches and choose the most appropriate for a variety of situations. Demonstrate a variety of sales closing techniques for various situations.

Instructional Resources

Text reference: Marketing: An Introduction, Chapter 11.

Enrichment Activities

1. With a variety of aviation products in the classroom, prepare a list of the features of each.
2. Using the same feature lists in #1 above, prepare a list of product benefits to aid in sales presentations.
3. Individually, using various products, conduct a sales presentation and closure using another student as a mock customer in front of the class.

Evaluation

Written exams, lists, personal sales presentations.

Unit 4	Forms of Business Ownership and Financing Options
Goal:	Students will be able to demonstrate a basic knowledge of the forms of business ownership in the United States and financing options available to them.
Timeline:	3 weeks

Content/Concept

1. All businesses in the United States take one of three basic forms - sole proprietorship, partnership or corporation. Each has its own unique advantages and disadvantages, including ease of management, capital requirements and liability.

2. In addition to deciding on the form of business to take, almost all businesses need financing - usually from a bank. Obtaining a loan from a bank for a business is almost an art. Once the technique is learned, the chances of obtaining a favorable ruling from a lender are increased significantly, greatly improving a company's chance of success.
3. A lender can also be a borrower's best friend if the borrower knows how to obtain the lender's help. Other sources are the Small Business Administration (SBA) and the borrower's Certified Public Accountant (CPA). Almost all of the help is available for free.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Outline the advantages and disadvantages of each of the three primary forms of business organizations. Evaluate which of each of the three types of business organizations would be most appropriate for each of a variety of business opportunities.
2. Explain the advantages and disadvantages of limited and unlimited liability for a business. Determine which of a variety of financing options would be most advantageous under a number of different circumstances.
3. Apply for a business loan with a commercial loan officer at a local bank and obtain a favorable loan decision from that loan officer.

Instructional Resources

Text reference: Entrepreneurship, Chapters 8, 10 and 11.
Supplemental reference: Small Business Administration brochures.

Content/Concept

1. All businesses operate within a maze of legal requirements imposed upon them by a myriad of governmental agencies. An understanding of the basic philosophy behind these regulations and the requirements imposed by them is essential to successful business operation.
2. Since all business managers and consumers are involved in the leasing or purchasing of products, the knowledge of the advantages and disadvantages of each, along with the responsibilities that go with leasing or ownership, is a basic necessity.
3. Aviation businesses are subject to additional regulations imposed by the FAA above and beyond that imposed on normal businesses. These regulations are imposed for the public safety and are strictly enforced. A thorough knowledge of these special regulations is essential for the operation of any aviation-related enterprise.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Identify the legal requirements for a valid, enforceable contract. Describe how sales contracts differ from other forms of contracts.
2. Explain transfer of ownership and risk of loss. Determine which would be most advantageous under a variety of circumstances, given a choice of purchasing products or leasing.
3. Demonstrate a thorough understanding of Federal Aviation Regulations and how they pertain to a variety of aerospace enterprises.

Instructional Resources

Text reference: Entrepreneurship, Chapters 15-18. Supplemental reference: Federal Aviation Regulations (FAR's).

Enrichment Activities

1. A member of SCORE will visit the classroom to talk about SBA financing and aid.
2. A commercial loan officer from a major bank will address the class about obtaining financing and what banks look for.
3. Students will survey local banks and list those willing to lend to the aerospace industry.

4. Students will make loan applications for a fictitious company and follow through with the loan until approval by a loan officer is made. (Process will be pre-arranged with several local banks.)
5. A CPA will address the class regarding the value of professional help and current trends in computerized business records.

Evaluation

Written tests, personal interviews with loan officers, results of surveys, obtaining of loan commitment from bank.

Unit 6	Purchasing a Business
Goal:	The student will be able to demonstrate the ability to analyze business purchase opportunities to determine the future potential for growth and/or sustaining claimed existing profitability. Students will also be able to determine the relative advantages and disadvantages of participating in a franchise operation.
Timeline:	3 weeks

Content/Concept

1. While often people go into business for themselves by starting a new business from scratch, it is usually the case that a new business owner purchases an existing business from someone else. While this may work, and be a good long-term investment, there are many pitfalls to avoid. Knowing where to look for a business to buy, who to go to to purchase it, and what to look for are some of the things any prospective purchaser should know.
2. What type of business to purchase is also a major consideration. Should it be a small, local operation or a locally owned franchise? How large a company can the new owner operate with the skills he/she has?
3. Along with the above is the analysis of a company's financial condition. Most people are not able to do a full analysis themselves, and need outside help from a CPA. However, a rudimentary knowledge of financial statements is a must for any prospective owner.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. List the sources of businesses for sale. Describe the advantages and disadvantages of buying an existing business.
2. Describe how to identify a good business opportunity. Explain how to evaluate a business for sale opportunity.
3. Explain some of the legal aspects of purchasing and operating a franchise. Evaluate the potential of a business for sale after reviewing appropriate financial statements.

Instructional Resources

Text reference: Entrepreneurship, Chapters 19, 20. Supplemental reference: SBA pamphlets on purchasing businesses.

Enrichment Activities

1. A speaker from a McDonald's or Burger King franchise will talk to the class about the advantages and pitfalls of owning any form of franchise.
2. A CPA will address the class about the analysis of financial statements of businesses for sale.
3. A commercial loan officer will address the class about financing for the purchase of an existing business.
4. Students will search through appropriate publications to find aviation-related businesses for sale and attempt to obtain information about the purchase price and terms of the business, with an evaluation of the prospects for future profitability.

Evaluation

Written tests, short papers written on business opportunities and financial statement analysis.

Unit 7 Personal Finances and Insurance

Goal: The student will be able to create his/her own personal financial statement on a bank form and on a computer disk to keep for future reference. The student will demonstrate an understanding of the necessity to maintain a good personal credit rating, and to maintain a personal financial condition which will allow a lender to grant additional loans in the future. The student will also be able to evaluate insurance alternatives to pick a type of policy most suited to themselves and a proposed company.

Timeline: 2 weeks

Content/Concept

1. In their zeal to make the businesses work profitably, many entrepreneurs forget to look after their personal finances. Often, even though the business may be doing well, the deterioration of the personal financial structure of the owner will lead to failure of the business itself. The ability to continue to maintain one's personal financial health is integral to the success of a business venture.
2. Maintenance of adequate insurance coverage, while not being over-insured, is a difficult concept to balance for the best of us. New businesses need the knowledge to sift through what is available and make intelligent decisions in this area.

Learning Objectives

Prior to successful completion of this unit, the student will be able to:

1. Accurately create a personal financial statement of their own financial condition. Evaluate the creditworthiness of practice borrowers to determine if they are qualified for new loans, using normal bank qualification ratios
2. State the purposes of various types of insurance and be able to choose the most appropriate for a variety of hypothetical situations.

Instructional Resources

Text reference: Entrepreneurship, Chapters 8 and 18.
Supplemental reference: outside brochures from the insurance industry.

Enrichment Activities

1. Classroom visit from a representative of Credit Data, Inc.
2. Classroom visit from a local insurance company representative.
3. Using computers, students will prepare their own personal financial statement to keep for their future use.

Evaluation

Written tests, creation of personal financial statements.

AEROSPACE 1-2 (K101)

PHILOSOPHY: Since aerospace and its technology touch the lives of all Americans, we believe it to be imperative that all responsible citizens should have an understanding of aerospace development.

INTRODUCTION: This course will help the student understand the contributions made by the aerospace industry for mankind's benefit.

PURPOSE: This course will introduce the students to the history and development of aerospace and its fundamentals, holding that it is essential to have an appreciation of the past in order to grasp the potentials of the future.

Unit 1	Aerospace History
Goal:	The students will demonstrate a knowledge of the history of aerospace and its ongoing developments.
Timeline:	12 weeks

Content/Concept

1. Origins of flight.
2. The formative years: 1904-1919.
3. The Golden Age: 1919-1939.
4. World War II.
5. Post-war years: 1945-1958.
6. The Gulf War.
7. Aerospace Age: 1958 - present.
8. The future.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Describe the origins of flight by the Chinese, the Greeks and Romans, by Leonardo da Vinci. Describe the three basic problems of flight.
2. Explain the development of commercial aviation during the formative years (1904-1919). List significant aviation events of the formative years.
3. Explain the development of commercial aviation during the Golden Age (1919-1939).
4. Describe the effects of World War I and World War II on the progress of aviation.
5. Trace the development of turbine aircraft and rotorcraft and the expanding role of commercial aviation as public transportation.
6. Compare and contrast the aviation advances of World War I, World War II and the Gulf War.
7. Describe the advancement of space travel and exploration.
8. Prepare a report on the future in aerospace.

Instructional Resources

Text reference: Aerospace: The Challenge, Chapters 1-1 through 1-6. Supplemental reference: Audio/visual tapes: "The Red Baron," "Fighter Aces of World War II," "Airlines," "The Early Years," "Space Shuttle: the Recovery," "Future Flight: Tomorrow's Airliner," "Flying Machines," "Dirigibles," "Charles Lindbergh," "Those Magnificent Flying Machines," "Reel Moments: Flight & Space," "Landing on Mars: Viking's Historic Mission," "The Wild Blue Yonder," "Apollo XI: The Eagle Has Landed."

Enrichment Activities

1. Oral presentations about a particular phase of history.
2. Build aircraft model and give oral presentations on the history of that aircraft (or on a person who flew that type of aircraft).

3. Team contest on design, build and write a report on a space station.
4. Guest speakers.
5. Design and build a timeline on the history of aerospace.
6. Call and/or write to an airline company and obtain information regarding the history of the aircraft they have used and/or built.
7. Design and build a dirigible.
8. Design and build a model of an early aircraft (3500 BC to 1939).

Evaluation

Construction of a flow chart, written, oral presentations and models, discussion, essay tests.

Comments

Quizzes will be given twice a week as well as a unit test at the end. A notebook will be turned in at the end of each unit.

Unit 2	The Flight Environment
Goal:	Students will comprehend weather information and understand the causes of weather phenomena in our atmosphere.
Timeline:	4 weeks

Content/Concept

1. The atmosphere.
2. Weather elements.
3. Weather forecasting.
4. Aviation weather.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Classify and illustrate the basic atmospheric regions.
2. Explain how the atmosphere and global pressure patterns affect weather.
3. List and define basic weather elements.

4. Describe aviation weather services available to pilots and demonstrate the proper uses of aviation weather reports, forecasts and charts.

Instructional Resources

Text reference: Aerospace: The Challenge, Chapters 2-1 through 2-4. Supplemental reference: National Geographic Space videos, NASA information pamphlets.

Enrichment Activities

1. Visits to and reports from weather facilities.

Evaluation

Draw and label, explain, written tests, practical test.

Unit 3	Aerospace Vehicles
Goal:	Students will gain a knowledge of military and civilian aircraft and rockets currently in use.
Timeline:	2 weeks

Content/Concept

1. Air carrier aircraft.
2. Instructional, personal and sport aviation.
3. Business and commercial aviation.
4. Military aviation.
5. Aircraft requiring little or no runway.
6. Rockets and missiles.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Identify those aircraft used as air carriers.
2. Differentiate between instructional, personal and sport aircraft.
3. Identify those aircraft used in business and commercial aviation.

4. Describe the different aircraft used for military operations and their identifiers.
5. Identify those aircraft requiring little or no runway.
6. Describe the different rockets and missiles used.

Instructional Resources

Text reference: Aerospace: The Challenge, Chapters 4-1 through 4-6. Supplemental reference: aircraft models, photos and films, field trips.

Enrichment Activities

1. Build model airplanes and/or rockets and explain them to the class.
2. Oral presentations about special aircraft.
3. Develop a chart to help identify different aircraft and missiles.

Evaluation

Discussion, written and oral presentations, written tests.

Unit 4	Principles of Aircraft Flight & Navigation
Goal:	Students will understand the fundamentals of aircraft aerodynamics, structures, propulsion and navigation.
Timeline:	10 weeks

Content/Concept

1. 1. Basic aeronautics: Newton's laws, airfoils, the four forces of flight.
2. Aircraft motion and control: the axes of rotation, weight and balance.
3. Aircraft structures and instruments.
4. Aircraft propulsion.
5. Navigation principles: compass, maps.
6. Navigational techniques and systems.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Explain and/or illustrate aerodynamic forces affecting flight. Apply Newton's three laws of motion. Describe the parts of an airfoil. Describe the four forces of flight.
2. Explain and/or illustrate aircraft motion and control. Describe the locations of the three axes of rotation with regard to a conventional airplane. Identify the conditions on an airplane with regard to weight and balance.
3. Identify basic aircraft structure and instrumentation.
4. Name the two basic types of engines used for aircraft propulsion.
5. Demonstrate basic air navigational principles through flight planning simulations. Identify the cardinal and intercardinal points on a compass. Interpret an aviation flight map.
6. Demonstrate basic air navigational techniques and systems through flight planning simulations.

Instructional Resources

Text reference: Aerospace: The Challenge, Chapters 3-1 through 3-6. Supplemental reference: Charts, field trips, model airplanes.

Enrichment Activities

1. Build model airplanes and/or rockets and explain their aerodynamic features.
2. Oral presentations on special aircraft design.

Evaluation

Oral and written presentations, drawings, practical tests, chapter tests, activity reports, demonstrations of flight: hot air balloon, kite, glider, quizzes.

Unit 5 Rocketry and Spacecraft

Goal: Students will gain a knowledge of rocket and space fundamentals.

Timeline: 4 weeks

Content/Concept

1. Rocket fundamentals.
2. Chemical propulsion.
3. Advanced propulsion systems.
4. Guidance and control.
5. The solar system.
6. Space beyond earth's orbit.
7. Orbits and trajectories.
8. Civilian spacecraft.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Demonstrate an understanding of rocket fundamentals, components and systems through the design, construction and launching of model rockets.
2. Describe the use of chemical propulsion in rocketry.
3. Describe the use of advanced propulsion systems in rocketry.
4. Describe the use of guidance and control in rocketry.
5. Explain the basic makeup of the solar system.
6. Describe the space environment and its effects on man and space travel.
7. Describe orbits and trajectories in space.
8. Discuss potential spacecraft use and propose future applications.

Instructional Resources

Text reference: Aerospace: The Challenge, Chapters 5-1 through 5-6, Chapters 2-5 through 2-6. Supplemental reference: NASA publications and information pamphlets, NASA videos, model rocket kits.

Enrichment Activities

1. Oral presentations on space and spacecraft - current and future.

Evaluation

Design, construct and launch model rockets, oral and written presentations, oral and written tests.

Unit 6 Aerospace Careers

Goal: Students will explore the aerospace industry, its activities, training requirements and career benefits.

Timeline: 4 weeks

Content/Concept

1. The meaning of aerospace power.
2. Military aerospace power.
3. Civilian aerospace programs.
4. The aerospace industry.
5. Aerospace training.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Discuss the meaning and significance of aerospace power.
2. Discuss the benefits and problems of maintaining a world prominence in aerospace.
3. Discuss the significance of civilian aerospace programs.
4. Describe the wide range of aerospace career opportunities.
5. Identify training requirements and educational opportunities available in the aerospace industry.

Instructional Resources

Text reference: Aerospace: The Challenge, Chapters 6-1 through 6-6. Supplemental reference: industry education and NASA information pamphlets.

Enrichment Activities

1. Oral presentations and reports regarding personal career interviews and visits to industry.

Evaluation

Oral discussions and presentations, written tests.

FLIGHT SAFETY

PHILOSOPHY: We recognize that our students must learn to demonstrate the physical and emotional behavior that will make them successful in the aerospace industry.

INTRODUCTION: Flight Safety encompasses self-esteem, stress management, nutrition, physical well-being, substance use and abuse, and visual and sensory problems, but is not limited to these health attitudes. Students will recognize and express the effects on the human body in relation to safety factors involved in the aerospace industry.

PURPOSE: This course will prepare the students to recognize their options, possibilities and alternatives in the aerospace industry, as well as goal setting and developing a plan of action.

Unit 1	Atmospheric Factors
Goal:	The student will examine the effects of atmospheric pressure on the human body.
Timeline:	1 1/2 weeks

Content/Concept

1. A general knowledge of the atmosphere is needed in order to understand how the body is affected in flight.
2. Changing barometric pressure, as occurs with changing altitudes, can affect a person's well-being.

Content/Concept

1. Knowledge of the circulatory and respiratory systems, and how they are affected in flight, is necessary in many areas of aerospace.
2. A person is more susceptible to hypoxia when they fly. Therefore, pilots and air traffic controllers need to know about hypoxia and the problems associated with it. Additionally, the symptoms of hyperventilation can be confused with the symptoms of hypoxia, yet the treatments are the opposite.
3. Proper nutrition is essential for the body to function at maximum efficiency.
4. A person needs to know how to control their behavior, so they may do their job in a safe manner.
5. Being physically fit and well rested enhances a person's physical and mental well-being, thus affecting their job performance.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Describe the primary functions of the circulatory and respiratory system and their relationship to flight.
2. Determine the symptoms, causes, prevention and treatment of hypoxia and hyperventilation.
3. List the basic nutrients and their function within the human body.
4. Explain positive and negative behavior change and its affect in doing a job.
5. State and demonstrate the mental and physical benefits of exercise and rest and how they affect a person's job.

Instructional Resources

Text reference: Modern Health, U.S. Army Field Manual 1-301, Jeppesen-Sanderson, Aviation Fundamentals, Chapter 8C, Private Pilot Medical Handbook. Supplemental reference: USAF Aerospace Physiological Training Program, Chapter 6, FAA and NASA publications, field trip.

Enrichment Activities

1. Make a model which shows how circulatory and respiratory systems interface.
2. Demonstrate the transfer of oxygen and carbon dioxide.
3. Create scenarios which use hyperventilation and/or hypoxia.

4. Demonstrate what someone should do when they experience hyperventilation and/or hypoxia.
5. Illustrate the different types of hypoxia.
6. Create a poster which shows the basic nutrients and/or how the body uses them.
7. Demonstrate how behavior affects the job performance and relationship with others.

Evaluation

Diagrams, written tests, oral presentations, lists, labeling and illustrations.

Unit 3 Visual and Sensory Factors

Goal: The student will discuss how visual and sensory factors affect a person's ability to do their job.

Timeline: 4 weeks

Content/Concept

1. Vision is the primary sense that is used in all aerospace-related fields, therefore knowledge of the principles and problems of vision is necessary.
2. If pilots trust their senses instead of the instruments, they may become disoriented in flight and an accident may occur. Therefore, understanding sensory illusions is necessary.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Identify principles and problems of vision as associated with aerospace.
2. Explain how sensory illusions can cause disorientation in flight.

Instructional Resources

Text reference: U.S. Army Field Manual 1-301, Chapters 8 and 9, Jeppesen-Sanderson, Aviation Fundamentals, Chapter 8C.
Supplemental reference: USAF Manual, Jeppesen-Sanderson overhead transparencies and video tape - Volume 8.

Enrichment Activities

1. Video different illusions and visual cues.
2. Make a model of the eye and label the parts.
3. Make a model and label the parts of the semi-circular canal and otolith organs.
4. Demonstrate the effects of light variations on the eye.
5. Develop a depth perception test and administer it.
6. Develop an eye examination and administer it.
7. Design a barony chair.

Evaluation

1. Illustrations, diagrams, charts, demonstrations, written tests and oral presentations.

Unit 4	Stress and Fatigue Factors
Goal:	The student will determine how stress and fatigue affect the body and describe recommended precautions.
Timeline:	4 weeks

Content/Concept

1. Many aerospace-related jobs are considered high stress occupations. Therefore, knowledge of stress and how to control or prevent it is essential for all aerospace students.
2. Fatigue affects a person's mental attitude and physical well-being.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Identify causes, types, stages and prevention of stress and of fatigue.

Instructional Resources

Text reference: U.S. Army Field Manual 1-301, Modern Health, Private Pilot Medical Handbook. Supplemental reference: Professional Pilot, Sept., 1989, Jeppesen-Sanderson, Aviation Fundamentals, Chapter 8D, USAF/US Navy Manual, FAA and NASA publications, Survival Sense for Pilots and Passengers.

Enrichment Activities

1. Demonstrate how stress and fatigue are related.
2. Develop a stress test and administer it.
3. Write a report on how self-imposed stresses can affect a person's activities and thought processes.
4. Devise ways aviation-related areas can be designed to reduce stress and fatigue.
5. Develop scenarios where a pilot's cockpit decision-making processes are affected by stress and fatigue.
6. Write a report on how self-imposed stresses can be reduced.

Evaluation

Written tests, lists and oral presentations.

Unit 5 Substance Abuse

Goal: The student will have an understanding of the physiological factors of drugs, alcohol and tobacco and how it affects the human body and impacts on their job.

Timeline: 4 weeks

Content/Concept

1. The use of drugs, alcohol and tobacco products can not only have a detrimental effect on one's health in the long term, but have an immediate effect on one's perception of reality and ability to function.
2. The FAA and related aerospace industries have strong regulations about the use of drugs, alcohol and tobacco.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Explain the basic guidelines for proper drug use. Identify the problems and treatment of drug, alcohol and tobacco abuse. Compare and describe how different drug groups affect the mind and body. Identify patterns of alcohol use and some reasons for this behavior. Explain how carbon monoxide affects the red blood cells in flight.
2. Review aerospace industry and FAA guidelines.

Instructional Resources

Text reference: Modern Health, Flight Physiology, Private Pilot's Medical Handbook, Physiological Training. Supplemental reference: Medical Facts For Pilots, guest speakers.

Enrichment Activities

1. Jeppesen-Sanderson videos.
2. FAA Aerodynamic videos.
3. South Mountain High School airport/simulator.
4. Visit air traffic control.

Evaluation

Daily/weekly quizzes, worksheets, student exercises, section quizzes, chapter tests.

Comments

Minimum competency required to complete this section is 70%.

Unit 6	Environmental Factors
Goal:	The student will have an understanding of how environmental factors can affect safe operation in the flight environment.
Timeline:	3 weeks

Content/Concept

1. Noise and vibration are significant factors in the onset of fatigue, reducing alertness and efficiency.
2. Toxic chemicals such as carbon monoxide can reduce alertness and induce death.
3. At high altitude, pressurization is essential for the human body to survive. Sudden decompression can cause loss of control or death.
4. Supplemental oxygen above 10,000 feet is essential for proper bodily function and mental alertness. Knowledge of the use of oxygen delivery equipment is essential.
5. In the close quarters of an aircraft, personal cleanliness and hygiene are important for crew efficiency. Maintenance of one's health must be an ongoing process to ensure continued employment and safety.

Learning Objectives

Prior to successful completion of this unit, the student will:

1. Explain the causes and physiological effects of aircraft noise and vibration.
2. Explain the effects of toxic substances found within the aviation environment.
3. Discuss the purpose, effects and systems of cabin pressurization and decompression.
4. Describe aircraft and personal oxygen equipment and systems. State when aircraft and personal oxygen equipment and systems are used.
5. Demonstrate proper aviation occupational industry standards and requirements concerning personal hygiene.

Instructional Resources

Text reference: U.S. Army Field Manual 1-301, U.S. Navy Manual, Survival Sense For Pilots and Passengers. Supplemental reference: USAF Field Manual, Aerospace & Physiology Training Program, field trips to WAFB, guest speakers.

Enrichment Activities

1. Model and label the parts of the ear.
2. Diagram how sound is transmitted and processed.
3. Write a report on how vibrations can be reduced.
4. Write a report on safety precautions regarding toxic aviation hazards.
5. Make a model to show how pressurization and decompression affect the aviator.

6. Write a report on a current incident involving loss of cabin pressurization.
7. Design an original oxygen system.
8. Compile a study of different companies' hygiene and dress requirements within the aerospace industry.

Evaluation

Written tests, demonstrations, lists, oral presentations, and labels.

AIRFRAME AND POWERPLANT MAINTENANCE TECHNOLOGY (AMT) AT SOUTH MOUNTAIN

This portion of the South Mountain High School Center for Aerospace Education is not yet completely developed. However, students interested in this field are studying at local aviation facilities including civil aviation operations and at military facilities. At these locations students are able to work on the latest technologies.

The shop facilities at South Mountain are used but they do not yet have all the requirements for a full-fledged FAA FAR Part 147 AMT program. However, South Mountain students in this option are being introduced to many of the categories that are stipulated by FAA regulations for this career field.

It is clear that the South Mountain faculty and administration plan to regularly expand and broaden this part of their program.

SECTION VI - SHAWNEE AVIATION MAGNET

The following material describing the Shawnee High School Aviation Magnet Program located in Louisville, Kentucky is adapted from the original aviation magnet program proposal submitted for funding to the United States Department of Education. Those planning a similar program and possible proposal may find the approach used to be helpful.

It should be noted that several years elapsed from the time the original planning took place and the final proposal was approved until the program was initiated.

AVIATION MAGNET PROGRAM

The proposal for an aviation magnet arose from a growing community need for skilled, knowledgeable employees in this field. Since establishing a major hub in Louisville just a few short years ago, United Parcel Services (UPS) has become the area's second largest employer. It currently has over 12,000 full-time and part-time employees and additional expansion is on the horizon. Moreover, UPS is now beginning to employ its own airline mechanics and technicians, rather than contracting for this work. At the same time, the local commercial airport (Standiford Air Field) is mid-way through the construction of its enlarged terminal and is preparing a multi-year expansion of its runways. Envisioning a community need for trained employees in both the passenger and freight air service areas, school district staff began meeting a year ago with representatives from all aspects of the aviation field. These discussions turned into scores of planning sessions and site visits and eventually shaped the magnet program that is presented in this proposal - a job program that will most definitely prepare today's students for tomorrow's jobs.

The Aviation magnet will be established at Shawnee High School, which is located in a predominantly black section of the city. This large school has had difficulty attracting students and is currently operating well under capacity. It has ample space to accommodate an additional 400 students in the aviation magnet.

Planning for this program has been underway for over a year. The principal and other school/district staff have visited aviation programs in five states, gathering information and learning from the experience of others. An advisory committee, including neighborhood parents, has guided the planning process. Ongoing input has been eagerly offered by UPS, Air Traffic Control, and Standiford and Bowman Air Fields. Substantial support has also been received from Embry-Riddle Aeronautical University in Daytona Beach, Florida, which wants to establish Shawnee as a feeder for its own post-secondary aviation training program. The Civil Air

Patrol will provide free curriculum materials and introductory staff training. The Federal Aviation Administration (FAA) is working with the planning committee to ensure that the program will meet certification standards necessary for future employment. General Electric is exploring ways to provide support through its jet engine manufacturing facility in Cincinnati, Ohio.

Following is a brief history of the Aviation Magnet planning activities that have occurred thus far.

April-May, 1988 - The principal and twenty staff persons visited sites of aviation magnets in Cleveland, Roanoke, Memphis, Indianapolis, Detroit.

May, 1988 - The principal visited Purdue University's Aviation School.

June-July, 1988 - The principal made several visits to Embry-Riddle Aeronautical University in Daytona Beach to discuss plans for a fifth- and sixth-year commercial pilot's program at Shawnee.

July, 1988 - The Jefferson County Public School(JCPS) Board of Education gave approval for staff to move ahead with planning the Shawnee Aviation Magnet proposal.

July, 1988 - Two teachers received a grant from the University of Louisville to prepare for the aviation magnet by correlating students' vocational education work with their language program, under the mentorship of a University psycholinguistics professor.

July, 1988 - January, 1989 - Newspaper articles and TV coverage alerted the community to the proposed aviation magnet.

August, 1988 - Staff members and the school's Community Advisory Council attended an inservice and luncheon with Robert Haynes of the Las Vegas Aerospace School.

August, 1988 - February, 1989 - Public response to information about the Shawnee Aviation Magnet has come in the form of phone queries and contacts with staff persons. People from all over the city/county area have manifested an interest in the proposed magnet.

September, 1988 - Two teachers attended the Great Lakes Region Aviation/Aerospace Conference at Purdue University.

October, 1988 - Financial support from the business community was affirmed at a luncheon at the airport.

Support from the Community Advisory Council at Shawnee was affirmed.

November, 1988 - The JCPS Board of Education accepted the Superintendent's recommendation that the Shawnee Aviation Magnet be initiated in 1989-90.

The aviation magnet will be a program within a school. Eventual anticipated enrollment is 800 students (200 per grade level); however, because of the complexity of this program and the need to build it gradually, students will be accepted only in grades 9 and 10 during the course of the two-year Magnet School Assistance Program (MSAP) project. The program will be aimed at all levels of student ability, not just the academically gifted. The program strands will include avionics, flight training, airframe and powerplant mechanics, travel and tourism, air traffic control, and customer services. All of these areas are currently experiencing a shortage of trained personnel in the job market.

GOALS AND OBJECTIVES

The overall goals of the Shawnee Aviation Magnet will be to provide an opportunity for high school students to pursue an aeronautical or aviation-related course of study, and to prepare students to seek employment and/or further education and training in the fields of aeronautics or aviation. The objectives of the program include the following:

Students: To increase academic achievement; to increase interest in school, thereby increasing attendance; to improve perception of the school environment; to motivate students to remain in school; and to move students toward specific goal-oriented accomplishments.

School: To establish and maintain Shawnee High School as a cornerstone of this community's economic growth; to increase and stabilize student enrollment; to further improve the community's perception of the school; to provide opportunities for students to prepare for employment in the aeronautical or aviation industry.

Community: To increase the community's awareness of the importance of the aeronautical and aviation industries to the economic development of Jefferson County, thereby removing a current and future barrier to economic growth; to foster school/community planning for student success; to establish and maintain a job skills development center.

School District: To provide leadership in the development of a magnet program designed to meet the educational/training needs of students from most levels of the academic stratum, and to transform Shawnee High School's teaching/learning environment into an integral part of Jefferson County's economic growth plans.

GENERAL PROGRAM DESCRIPTION

Since employment opportunities in the aeronautical and aviation industries range from baggage handlers to pilots, from skycaps to aircraft mechanics, and from shipping clerks to air traffic controllers, the Shawnee Aviation Magnet Program will be open to students from various special education programs as well as the regular, honors and advanced programs. Therefore, the program will be a model to provide Shawnee students with the technical skills for employment in the aviation industry and the academic skills for continued advancement in their life goals. The meshing of these two areas, technical training and academic instruction, will provide Shawnee students with an integrated approach to their education. It will provide them with the requirements for obtaining a diploma as well as the training to make them employable in the aviation field. Thus the aviation program will be the means of imparting technical knowledge and the means of developing related curricula in English, science, mathematics and social studies.

The Aviation Magnet will utilize district-wide curriculum guidelines in the development of courses of study related to aviation. The staff in each department will write new courses of study for that subject area, so that established Jefferson County guidelines can be integrated with the study of aviation. This interdisciplinary approach will be the vehicle for providing opportunities in a variety of activities. It will merge academic and technical theory and application.

MAJOR PROGRAM COMPONENTS

Students enrolling in the Aviation Magnet will be offered an Aviation Exploratory phase in the ninth grade, in addition to their core classes. They will explore aviation-related jobs at the entry level, technical level, and professional level. They will hear speakers from the aviation industry and take aviation-related field trips. Students will also receive assessment to further ascertain their interest, aptitude, and ability.

In the tenth, eleventh and twelfth grades, these students will follow the core academic curriculum and begin an intensive course of studies in the aviation specialty of their choice for entry level jobs, technical level jobs or professional level jobs. Having been prepared for more responsible decision-making due to their experiences in the Exploratory Program, the students can anticipate greater success and will be able to choose wisely from several options in the Aviation Magnet. The options, described in greater detail below, will include:

A. Flight Training
B. Air Traffic Control
C. Airframe and Powerplant Technology
D. Avionics
E. Customer Services
F. Travel and Tourism

A. Flight Training Program

The Flight Training Program is designed to provide students with preparation leading to the issuance of a private pilot's license. Students will be provided instruction in navigation, meteorology, aviation regulations, law and safety, aeronautics, and flight instruction. The flight portion will include at least 40 hours of flight instruction and supervised solo flight time. Students will be required to receive 20 hours of flight instruction from an authorized flight instructor including at least:

1. Three (3) hours cross country.
2. Three (3) hours night flight.
3. Three (3) hours in airplane preparation for the private pilot flight test.

The students are required to receive (20) hours of solo flight time, including at least:

1. Ten (10) hours in airplanes.
2. Ten (10) hours of cross country flights.
3. Three (3) solo takeoffs and landings to a full stop at an airport with an operating control tower.

Students will also receive instruction in preparation for the private pilot flight test and an overview of aircraft engines and systems. To be eligible for the program, students must be at least age 17 and meet certain physical requirements as directed by the FAA. The Civil Air Patrol will offer educational materials, serve as a resource and assist in the preparation for flight training.

B. Air Traffic Control

The Air Traffic Control Program is designed to prepare students for the FAA training programs after high school. Students will be provided training in the use of radar, scanning devices, computers, navigational skills, and communication skills. The major instructional areas are: weather theory, ground control procedures, air traffic communication procedures, decision-making/creative problem-solving, geographic referencing, clearances and separations, and aeronautical charts. Students will also receive instruction in the following:

1. Navigation.
2. Stress management.
3. Test preparation and practice.

Opportunities will be provided for students to participate in simulated flight control, visit actual control towers and work with practitioners.

C. Aviation Maintenance Technology

The Aviation Maintenance Program is designed to prepare students for a career in Airframe and/or Powerplant Technology. It prepares the students to take the Federal Aviation Administration (FAA) written, oral and practical examinations for certification and rating (license) in Aviation Maintenance Technology. Students will be provided the technical knowledge and skills needed to maintain, repair, and inspect aircraft, including reciprocating and turbine engines, as well as component systems, both electric and hydraulic. Emphasis will also be placed on a general curriculum including mathematics, basic physics, blueprint reading, etc. Opportunities will be provided for students to be exposed to practitioners in the area of Aviation Maintenance Technology.

The laboratories will contain up-to-date equipment and specialty tools. Students will work in T hangars and test cells. Aircraft will be available for practical hands-on experiences. Working with fixed-base operators and large aviation units, students will be exposed to the practices and operations which will be needed for FAA certification.

Specific areas in which students will receive instruction are as follows:

Grade 9:	Basic Mathematics
	Basic Electricity
	Materials and Processes
Grade 10:	Fluids and Fittings
	Cleaning and Corrosion
	Weight and Balance
	Airframe Structures - wood, metal, composites

and other subjects related to Aviation Maintenance Technology such as welding, lubrication and environmental control.

E. Customer Services Area

The Customer Services Program is designed to enable students to enter the aviation industry as: baggage handlers, skycaps, food service workers, car rental personnel, flight information personnel, airport maintenance workers, security staff, cashiers, etc. Students interested in Customer Service jobs will receive instruction in: computer skills, communications, sales, cashiering, customer relations, and food preparation.

Aviation Magnet Retail Area:

D201	Introduction to Retailing
D302	Retailing I
D402	Related Retail Training

The three courses mentioned above will be utilized in order to satisfy state guidelines in the program of studies. Special emphasis will be placed on the aviation field as students explore careers in D302 (Retailing). Job possibilities will range from airline ticket sales clerk to supervisor. Other areas will include customer service jobs and gift shop employees.

Flight Attendant

The flight attendant program is a part of Customer Services in which students are prepared to attend the FAA-approved flight attendant program. Students will receive the basics of customer relations, food preparation, and aviation regulations, laws and safety practices.

F. Travel and Tourism

The Travel and Tourism portion of the program will provide students with actual hands-on experiences with travel booking. Through an adopt-a-school plan, a travel agency will develop and sponsor a center at Shawnee. Students will have opportunities to actually book travel, make arrangements, schedule flights, secure tickets and operate a specially-designed computer program for travel agents.

ADMISSION POLICIES FOR AVIATION MAGNET:

1. Students must complete an interest/occupational test;
2. Student/parent interviews required;
3. Students must have a minimum of two recommendations from teachers of academic subjects;
4. Students must have a 2.5 or above GPA for admission to Airframe and Powerplant, Air Traffic Control, Avionics, and Flight Training Programs;

BEST COPY AVAILABLE

5. Students must have 2.0 or above GPA for admission to Customer Service and Travel/Tourism Programs;
6. Students must demonstrate a proficiency in math to meet requirements of certain programs;
7. Students must have achieved a minimum of "c" in English and Science to meet requirements of certain programs;
8. Students must have and maintain a record of good attendance.

SCHOOL SUPPORT OF THE AVIATION MAGNET

The Shawnee Aviation Magnet will be one component of the educational program offered at Shawnee. The staff are committed to incorporating knowledge and skills applicable to the Aviation Magnet in the existing framework of the scope and sequence of the various curricular areas. The academic offerings at Shawnee will follow the curriculum design of regular Jefferson County High Schools with an overlay of aviation-related material where applicable.

The English teachers will continue to provide instruction in literature, language utilization and writing skills as applicable to the scope and sequence format for each grade level. However, these teachers are also committed to incorporating vocabulary and literature studies related to aviation and to including writing tasks that will involve the development of communication skills for those in the aviation magnet. One English teacher is currently involved in a University of Louisville grant to correlate students' vocational classes with English lessons. Communication skills are essential for all students in the aviation magnet, but they are crucial skills for air traffic controllers.

The math teachers are committed to including aviation-related examples in their classes. In ninth grade Math Fundamentals classes, students will learn to read tables and clocks, to calculate fuel consumption, and to estimate weights, measures and distances. In algebra classes, students will learn about vectors, altitude, latitude and longitude; be involved in problem-solving techniques; and learn to estimate winds. Geometry students will learn about compass bearings, altitude, longitude and latitude, and airplane design. Pre-calculus students will learn about polar coordinates, combustion and vectors. Consumer math students will learn about ticket sales, measuring and weighing, time schedules, figuring distances and basic accounting skills. In trigonometry, the students will study basic navigational skills, altitude, latitude and longitude and radar.

The science teachers are committed to incorporating aviation-related material in their course offerings. The ninth grade integrated sciences class will give students an overview of chemistry, physics, astronomy, biology, ecology, and physical science. Units on weather and aviation are included in this scope and sequence. Tenth grade students in biology will learn about the effects of weightlessness and the effects of flight and pressure on the human body. They will also study the nutritional value of food. In physics, there will be a unit on quality control; as there is a staff teacher with 21 years experience in commercial quality control, this will be an important area of study.

The social studies teachers are committed to correlating historical research and cartography with aviation. In U.S. History, the students will build model airplanes and study the history of navigation and flight, the history of commercial flight, and the biographies of people in aviation. Students will interview local persons who played roles in military and commercial aviation for a special unit on the importance of aviation in the history of this county.

The business teachers are committed to developing those communication skills needed by people working in the aviation industry. In General Business, the students will be introduced to the business world with units on banking, insurance, marketing and sales. They will improve communication skills with typing, shorthand, record-keeping and computer use. They will learn accounting and, as seniors, be able to participate in the Model Office Program.

The foreign language teachers are committed to providing those skills in written and conversational French and Spanish which will enable students in the Aviation Magnet to be successful in international airport situations. These skills will enhance the opportunities of some students to obtain jobs in the aviation service industry as reservationists, flight attendants, etc.

The Home Economics teacher will be directly involved in enabling certain students to learn the essentials of food preparation as it relates to the aviation industry. This instruction will include packaging as well as preparing food.

The Special Education department teachers will have the opportunity, as resource personnel, to help their students improve communication, math and science skills relative to the Aviation Magnet. One teacher of learning disabled students is currently involved in a University of Louisville grant to learn how to correlate students' vocational classes with English lessons. Another special education teacher has had extensive experience in military aviation. The teacher of trainable mentally handicapped students is committed to helping these students become involved in the aviation industry as a part of Community-Based Education.

These students could work in food packaging and airport maintenance.

The R.O.T.C. staff are committed to dovetailing certain units of study with the Aviation Magnet. There are units of study on astronomy, survival skills, electricity and naval electronics. There are also units on fire fighting, world geography, introduction to navigation and time, and meteorology. One of the instructors in this program has 30 years experience in naval aviation, advanced systems operations, and in instructing naval aviation personnel.

CORRELATION OF AVIATION MAGNET WITH SPECIAL PROGRAMS

All Shawnee students will benefit from special programs developed by certain staff members for improvement of academic and personal skills. These programs may have a special impact on the Aviation Magnet students.

One such program is Creative Problem-Solving in which students learn to develop their problem-solving skills through many group and individualized activities. They learn about group dynamics, risk-taking, and work through multi-voting processes to improve their skills. They take part in competitions based on their ability to think creatively. As problem-solving is a critical skill for aviation jobs, there are many opportunities for students with this experience.

The Reading Resource teachers offer a special program of assistance to any teacher or student in the building. They are instrumental in helping teachers plan units, find materials and work with small groups in the classroom. They will help integrate aviation studies in the classes with the resources they provide. In addition, they will work with individual students who express a desire for such help. As test-taking skills are essential to students involved in most of the aviation-related jobs, the resources of these teachers will be additionally beneficial to Aviation Magnet students.

The Wellness Lab in the Physical Education department is designed to benefit students in maintaining health and reducing stress. This is done scientifically through a medical profile, fitness screening, stress management techniques, nutritional prescriptions, and individualized exercise programs. As controlling stress is important in every area of the aviation industry, especially for air traffic controllers, this lab will provide essential skill techniques for the aviation students.

A Leadership Training Program focuses on leadership seminars and pairing students with young leaders from a local college in an instructional program sponsored by a national corporation. The students are given the opportunity to meet with local business leaders and to develop leadership skills in seminar training labs. Developing leadership depends on assessing persons and situations correctly and acting on this information. This program will enhance the aviation program with its focus on these skills.

The Transition Program is designed to help all ninth graders make the move from middle to high school. Students desirous of entering the Aviation Magnet will benefit from the cooperative programming venture established by Shawnee staff and an area middle school to facilitate students in the transition to high school. Those students interested in the Aviation Magnet will have a team of teachers from their middle school and from Shawnee to help them in their decision-making process.

The Local Scholars Program has been established by a staff person to help the above-average students at Shawnee realize their potential in their classwork and be aided in their plans for the future. It is a program to keep ninth graders on target and in school by utilizing teacher mentors to encourage students. It is also designed to help upperclassmen maintain good grades and prepare for the SAT, ACT, etc. Teacher mentors monitor the grades of the scholars in their respective groups. The teacher mentors maintain a close relationship with their group of four or five students, providing encouragement and advice during the year. Students in the Aviation Magnet will have a teacher/mentor who monitors their progress in all study areas.

Shawnee has implemented a Cultural Resources Program for several years. Through this program, writer/dramatists have been brought to Shawnee for Artist-in-Residence contracts with the Kentucky Arts Council. These residencies have usually lasted for several months. the goal of the writing residencies has been to correlate everyday experiences and classroom activities with creative writing. Communication skills for students in the aviation classes could be enhanced with opportunities for role-playing, skit-writing, and peer tutoring.

Shawnee has a Computer Lab Tutorial Program for all students. The computer lab houses 32 computers with printers and has many unique features, including a network system within the lab, PC data viewers, and the potential to hook up with Compuserve and other networks. With the capabilities offered by this lab, students could simulate experiences connected with certain jobs in aviation. They could make flight reservations with a modem, look at weather reports for flying, and look at flight schedules. There is also the possibility in the lab for commercial on-line hookup and a potential for flight simulation software.

The Shawnee student newspaper will provide learning experiences in the Aviation Magnet. Not only will the paper provide information about the program to the whole community, but the newspaper will inform students in middle schools about how they can become part of the aviation program at Shawnee.

The Academic Skill and Intervention Program with the University of Louisville is a collaborative effort between Shawnee and the University to target the specific needs of tenth graders and offer applicable solutions. The program includes inservice for Shawnee staff, the installation of a tutorial lab which will connect with the University's mainframe, and pre- and post-testing of all Shawnee tenth graders. The next phase of the program involves creation of remedial and/or enhancement programs. The program will benefit all tenth grade students. Those needing skill remediation will have a prescription to follow. Gifted students will have an enhancement program to fit their goals and learning style.

Shawnee is one of 28 schools in the nation to be involved with a statistical analysis program offered by educational television (ETV). The school has a hookup to the mainframe and students work under the tutelage of an ETV instructor to do statistical analysis.

The Louisville Education and Employment Partnership is a pre-employment skills program which functions to teach Shawnee students employment skills and work maturity skills while offering remediation in basic subjects where necessary. The goals of the project for the participants are placement in the world of work and retention of jobs. The Partnership, which is funded by the Private Industry Council, has a placement officer who works with students to determine occupational goals and to take practical steps in realizing those goals. The placement officer also finds jobs for the participating students.

Shawnee has a Student Mediation Program. A group of students has undergone training in mediation skill techniques and has been engaged in helping to troubleshoot and mediate some disputes between students. This area will offer unique skill development opportunities to Aviation Magnet students and will enhance the interpersonal skills especially needed by ticket agents and flight attendants.

Shawnee will have an instructional coordinator to facilitate the correlation of the Aviation Magnet with the mainstream programs in this high school. This person will also be responsible for developing promotional programs about the Aviation Magnet for implementation in elementary and middle schools.

Shawnee will have a placement officer who will serve the Aviation Magnet by finding jobs for its graduates. The Louisville Education and Employment Partnership Project will also assist in locating jobs, such as positions with UPS, the Airport Authority and other aviation-related positions.

PROGRAM OF STUDIES

Following is the four-year program of studies for each of the aviation strands to be offered at the Shawnee Magnet School.

SHAWNEE HIGH AVIATION PROGRAM

AIRFRAME/POWERPLANT MECHANICS PROGRAM

First Semester	Second Semester
9A	9B
E102/E1H0 - English	E102/E1H2 - English
X102/E1H2 - Mathematics	X102/X1H2 - Mathematics
C105 - Integrated Science	C105 - Integrated Science
P101 - P.E./Health	P101 - P.E./Health
1 Hour General AMT Lab*	1 Hour General AMT Lab
S201/S2H1 - World Civilization	S201/S2H1 Civilization
10A	10B
E202/E2H2 - English	E202/E2H2 - English
X202 - Geometry	X202/X2H2 - Geometry
C303 - Chemistry	C303 - Chemistry
2 Hour General AMT Lab	2 Hour General AMT Lab
S301/S3HO - U.S. History	S301/S3HO - U.S. History
11A	11B
E302/E3H2 - English	E302/E3H2 - English
X301 - Intro to Computer	X301 - Intro to Computer
C401 - Chemistry	C402/C4H2 - Physics
3 Hour General AMT Lab	3 Hour General AMT Lab
12A	12B
E402/E4H2 - English	E402/E4H2 - English
X302/X400 - Elective/Science/ Foreign Language	X302/X400 - Elective/Science/ Foreign Language
3 Hour General AMT Lab	3 Hour General AMT Lab

Note: Student may need to attend during Summer Session to meet FAA regulation of 1900 hours.

*AMT = Aviation Maintenance Technician

SHAWNEE HIGH AVIATION PROGRAM

AVIONICS

First Semester	Second Semester
9A	9B
E102/E1H2 - English	E102/E1H2 - English
X102 - Mathematics	X102 - Mathematics
C105 - Integrated Science	C105 - Integrated Science
P100/P102 - P.E./Health	P100/P102 - P.E./Health
S201 - World Civilization	S201 - World Civilization
1 Hour JAVA I*	1 Hour JAVA I*
10A	10B
E202/E2H2 - English	E202/E2H2 - English
X202 - Mathematics	X202 - Mathematics
C303 - Chemistry	C303 - Chemistry
C302 (Aerospace Science)	C302 (Aerospace Science)
1 Hour General Avionics Lab	1 Hour General Avionics Lab
ELECTIVE	ELECTIVE
11A	11B
E302/E3H2 - English	E302/E3H2 - English
X302 - Mathematics	X302 - Mathematics
C402 - Chemistry	C402 - Chemistry
S301/S3HO U.S. History	S301/S3HO U.S. History
2 Hour General Avionics Lab	2 Hour General Avionics Lab
12A	12B
E402/E4H2 - English	E402/E4H2 - English
X4HO - Mathematics	X4HO - Mathematics
C201 or C307 or C401	C201 or C307 or C401
U400 - Humanities	U400 - Humanities
2 Hour General Avionics Lab	2 Hour General Avionics Lab

*JATA = Joint Academic Vocational Alternative

SHAWNEE HIGH AVIATION PROGRAM

AIR TRAFFIC CONTROL

First Semester	Second Semester
9A	9B
E102/E1H2 - English X102 - Mathematics C105 - Chemistry P100/P102 - P.E./Health S201 - Social Studies 1 Hour JAVA I Control	E102/E1H2 - English X102 - Mathematics C105 - Chemistry P100/P102 - P.E./Health S201 - Social Studies 1 Hour JAVA I Control
10A	10B
E202/E2H2 - English X202 - Mathematics C303 - Chemistry C302 (Aerospace Science) 1 Hour General Air Traffic Control ELECTIVE	E202/E2H2 - English X202 - Mathematics C303 - Chemistry C302 (Aerospace Science) 1 Hour General Air Traffic Control ELECTIVE
11A	11B
E302/E3H2 - English X302 - Mathematics C402 - Science S301/S3HO U.S. History 2 Hour General Air Traffic Control	E302/E3H2 - English X302 - Mathematics C402 - Science S301/S3HO - U.S. History 2 Hour General Air Traffic Control
12A	12B
E402/E4H2 - English X4HO - Mathematics C200 or C307 or C401 U400 - Humanities 2 Hour General Air Traffic Control	E402/E4H2 - English X4HO - Mathematics C201 or C307 or C401 U400- Humanities 2 Hour General Air Traffic Control

SHAWNEE HIGH AVIATION PROGRAM

FLIGHT TRAINING

First Semester	Second Semester
9A	9B
E102/E1H2 - English	E102/E1H2 - English
X102 - Mathematics	X102 - Mathematics
C105 - Science	C105 - Science
P100/P102 - P.E./Health	P100/P102 - P.E./Health
S201 - World Civilization	S201 - World Civilization
1 Hour JAVA I	1 Hour JAVA I
10A	10B
E202/E2H2 - English	E202/E2H2 - English
X202 - Mathematics	X202 - Mathematics
C303 - Chemistry	C303 - Chemistry
C302 (Aerospace Science)	C302 (Aerospace Science)
1 Hour General Flight Training	1 Hour General Flight Training
ELECTIVE	ELECTIVE
11A	11B
E302/E3H2 - English	E302/E3H2 - English
X302 - Mathematics	X302 - Mathematics
C402 - Science	C402 - Chemistry
S301/S3HO U.S. History	S301/S3HO - U.S. History
2 Hour General Flight Training	2 Hour General Flight Training
12A	12B
E402/E4H2 - English	E402/E4H2 - English
X4HO - Mathematics	X4HO - Mathematics
C200 or C307 or C401	C201 or C307 or C401
U400 - Humanities	U400 - Humanities
2 Hour General Flight Training	2 Hour General Flight Training

SHAWNEE HIGH AVIATION PROGRAM

AIRFRAME/POWERPLANT MECHANICS PROGRAM*

First Semester	Second Semester
9A	9B
E100/101 - English	E100/101 - English
X100/101 - Mathematics	X100/101 - Mathematics
C105 - Science	C105 - Science
P100 - P.E./Health	P101 - P.E./Health
JAVA I	JAVA I
S200 - Geography	S200 - Geography
10A	10B
E200/202 - English	E200/201 - English
X200/X102 - Essential Math/Alg. I	X200/X102 - Essential Math/Alg. I
C201 - Biology	C201 - Biology
B200 - Typing	B200 - Typing
French I/Spanish/Elective	French I/Spanish/Elective
D201 - Intro to Retailing	D201 - Intro to Retailing
11A	11B
E300/301 - English	E300/201 - English
X300/X202 - Mathematics	X300/X202 - Mathematics
C300/C303 - Science	C300/C303 - Science
S301 - Social Studies	S301 - Social Studies
D302 - Retailing I	D302 - Retailing I
ELECTIVE	ELECTIVE
12A	12B
E400/401 - English	E400/E401 - English
B310-Intro to Data Processing	B310 - Intro to Data Processing
U400 - Humanities	U400 - Humanities
D402 - Co-op	D402 - Co-op

*This AMT option differs from the previous one because this one allows for co-op work assignments and some different elective courses.

GOALS, OBJECTIVES AND TIMEFRAMES

Project Goal

To increase voluntary intra-district transfers to elementary and secondary magnets by students of all racial/ethnic/social backgrounds, thereby improving racial balance in these and other district schools.

Magnet Component

Aviation Magnet Program - Shawnee High School

Component Objective

By June, 1991 at least 50% of the total enrollment in the aviation magnet program will consist of voluntary intra-district transfers and the total enrollment of minority students in the program will reflect the district's racial percentage, thereby preventing minority group isolation as evidenced by pupil demographic data.

Activities and Timeframes

1. Develop a plan to recruit students of all racial/ethnic/social backgrounds to the aviation school.
   July, August, December, 1989   January, 1990

2. Prepare recruitment materials that include brochures, radio spots, television announcements and billboards; devise a media campaign, and schedule recruiting activities.
   July, 1989 through June, 1991

3. Implement the plan, including after-school enrichment and summer programs.
   August, 1989   February - August, 1990

4. Determine the enrollment in the aviation school.
   September, 1989   September, 1990

5. Analyze the enrollment data to determine the percentage of voluntary intra-district transfers and the percentage of minority students.
   October, 1989   October, 1990

6. Assess the impact of the recruiting materials, media campaign and activities.
   October, November, 1989   October, November, 1990

7. Revise the plan based upon feedback.
   December, 1989   January, December, 1990   January, 1991

8. Implement the revised plan.
   February - June, 1991

Project Goal

To attract an increasing number of students from the private/parochial sector and to reduce transfers to that sector.

Magnet Component

Aviation Magnet Program - Shawnee High School

Component Objective

By June, 1991 at least 5% of the total enrollment in the aviation magnet program will consist of students who were previously enrolled in private/parochial schools, as documented by enrollment records.

Activities and Timeframes

1. Develop a plan to recruit students from private/parochial schools.
   July, August, December, 1989 January, 1990
2. Prepare recruitment materials that include brochures, radio spots, television announcements and billboards; devise a media campaign, and schedule recruiting activities.
   July, 1989 through June, 1991
3. Implement the plan, including summer enrichment program.
   August, 1989 February - August, 1990
4. Determine the enrollment in the aviation school.
   September, 1989 September, 1990
5. Analyze the enrollment data to determine the percentage of students who were previously enrolled in private/parochial schools.
   October, 1989 October, 1990
6. Assess the impact of the recruiting materials, media campaign and activities.
   October, November, 1989 October, November, 1990
7. Revise the plan based upon feedback.
   December, 1989 January, November, December, 1990
8. Implement the revised plan.
   January - June, 1991

Project Goal

To increase parent/community satisfaction with the desegregation plan by utilizing magnet schools to increase their involvement and decision making with regard to their children's education.

Magnet Component

Aviation Magnet Program - Shawnee High School

Component Objective

By January, 1990 an international studies magnet school parent/community involvement component will be established that ensures sharing of information about the magnet school project (including academic instruction and planning to prevent resegregation) and enlists parent/community contributions as evidenced by a list of activities and parent/community participants.

Activities and Timeframes

1. Hold parent orientation meetings to explain the aviation program in general.
   August, September, 1989

2. Conduct parent workshops to focus on specific aspects of the aviation curriculum.
   October - December, 1989 January - June, October - December, 1990 January - June, 1991

3. Coordinate parent education/discussion groups that will enable parents to support their children's educational development, help them evaluate career choices, and make secondary and post-secondary education plans.
   October - December, 1989 January - June, October - December, 1990 January - June, 1991

4. Plan Open House activities and classroom visits to encourage parent/student interaction.
   September - December, 1989 January - June, September - December, 1990 January - June, 1991

5. Select members of the school's parent/community advisory committee.
   September, 1989 September, 1990

6. Schedule meetings of the parent/community advisory committee on a regular basis to involve them in the ongoing work of the aviation magnet schools.
   September - December, 1989 January - June, September - December, 1990 January - June, 1991

7. Develop and implement training sessions for parents that will engage them directly in recruitment programs and encourage them to share learning choice information and decision making strategies with other parents.
   September, 1989 through June, 1991

8. Establish and maintain regular contact with parents through notes, calls and program newsletter.
   September, 1989 through June, 1991

9. Identify parent/community volunteers in each school to establish linkages between the school, the business community and the aviation industry.
   September, 1989 through June, 1991

10. Coordinate volunteer activities.
    September, 1989 through June, 1991

11. Develop and implement public information strategies to increase public awareness of the aviation program; strategies to include brochures, television announcements and billboards.
    August, 1989 through June, 1991

Project Goal

To increase student achievement in basic academic skills subject areas.

Magnet Component

Aviation Magnet Program - Shawnee High School

Component Objective

By June, 1990 and by June, 1991 the average scores of the students enrolled in the aviation program will exceed by 5 percentile points the district average for each grade level on the CTBS-4 reading comprehension and math subtests.

Activities and Timeframes

1. Develop a curriculum which integrates the components of the aviation curriculum (avionics, flight training, airframe and

powerplant mechanics, travel and tourism, air traffic control and customer services), with the existing district curriculum.
July - October, 1989

2. Requisition equipment and supplies which correlate with the curricular objectives of the aviation magnet schools and establish the workshops, laboratories, and simulation areas needed to implement the aviation program.
July, 1989 through June, 1991

3. Conduct inservice programs for teachers, aides and administrators related to the implementation of the aviation program, including training in the search for "curricular complements," the design of interdisciplinary units, and the infusion of aviation studies concepts in other content areas.
July, 1989 through June, 1990

4. Implement the curriculum to provide both technical skills for employment in the aviation industry and academic skills for post-secondary study.
August, 1989 through June, 1991

5. Monitor and adjust the implementation of the curricular objectives.
August, 1989 through June, 1991

6. Evaluate reading comprehension and math achievement using the CTBS-4 reading comprehension and math subtests.
August, 1990 May, 1991

Project Goal

To use magnet schools curricula to strengthen students' grasp of marketable skills via career awareness at the elementary level, career exploration at the middle school level, and career preparation at the high school level.

Magnet Component

Aviation Magnet Program - Shawnee High School

Component Objective

By June, 1991 students in the aviation magnet program will demonstrate knowledge of marketable skills by participating in career awareness, exploration, and preparation at the high school level as evidenced by curriculum documents, daily lesson plans, records of student activities, and student performance on teacher-made evaluation instruments.

Activities and Timeframes

1. Develop an aviation career awareness, exploration and preparation program, teacher-made evaluation instruments and activities schedules.
August - December, 1989

2. Provide inservice for teachers and administrators to facilitate the implementation of the curriculum.
August - December, 1989

3. Implement the curriculum which provides for aviation exploratory experiences and an intensive course of studies to prepare for entry-level technical and professional jobs in avionics, flight training, airframe and powerplant mechanics, travel and tourism, air traffic control and customer services.
August - December, 1989 January - June, August - December, 1990 January - June, 1991

4. Develop and implement career counseling/job search skills program.
August, 1989 through June, 1991

5. Develop and implement after-school enrichment and summer programs.
August, 1989 through June, 1991

6. Develop an adopt-a-school program with a local travel agency and establish a working travel agency at Shawnee.
August, 1989 through June, 1991

7. Coordinate community-based "shadowing" experiences at airports and travel agencies.
August, 1989 through June, 1991

8. Establish a support group to ensure close communication between the school, business community and local groups such as the Civil Air Patrol to facilitate the implementation of the career program.
August, 1989 through June, 1991

9. Work with Butler Aviation to provide flight training.
August, 1989 through June, 1991

10. Administer evaluation instruments and document student activities.
    August, 1989 through June, 1990 August, 1990 through **June, 1991**

11. Revise curriculum and activities based upon feedback.
    July, 1990 through June, 1991

Project Goal

To enhance staff ability to develop, revise, and implement challenging curricular content and approaches.

Magnet Component

Aviation Magnet Program - Shawnee High School

Component Objective

By June, 1991 specially trained teachers will have participated in staff development activities, developed curriculum and implemented the aviation school magnet program as evidenced by inservice attendance records, curriculum documents, and daily lesson plans.

Activities and Timeframes

1. Conduct staff development activities for teachers and administrators which afford extensive training in the search for "curricular complements," the design of interdisciplinary units, and the infusion of aviation studies concepts in other content areas.
   July - October, 1989

2. Develop curriculum which emphasizes learning choice and integrates the aviation curriculum with the district's existing curriculum.
   July - December, 1989

3. Conduct ongoing inservice programs for teachers and administrators related to the implementation of the aviation curriculum.
   August, 1989 through June, 1991

4. Implement the aviation curriculum at the magnet site.
   August, 1989 through June, 1991

5. Monitor and adjust curriculum and implementation strategies.
   August, 1989 through June, 1991

6. Provide support services for teachers and administrators and establish a collaborative support group to ensure close communication between grade levels.
August, 1989 through June, 1991

BUDGET SUBMITTED IN PROPOSAL

Aviation Magnet Program - Shawnee High School

Personnel

Aircraft Maintenance Technology Teacher (200 days) 2 @ $32,430	$ 64,860
Avionics Teacher (200 days) 1 @ $32,430	32,430
Flight Training Teacher (200 days) 1 @ $32,430	32,430
Travel/Tourism Teacher (200 days) 1 @ $32,430	32,430
Aviation Resource Teacher (200 days) 1 @ $32,430	32,430
Customer Services Teacher (200 days) 1 @ $32,430	32,430
Air Traffic Control Teacher (200 days) 1 @ $32,430	32,430
Personnel Subtotal	$259,440

Fringe Benefits

Fringe Benefits (Certified) $259,440 x 16.5%	$ 42,811
Fringe Benefits Subtotal	$ 42,811

Equipment

Simulation console (complete modular system) for Air Traffic Control		$ 25,000
Sewing Machine	2 @ $600	1,200
Spot Welder, 208V 1ph	1 @ $500	500
Punch Press, Turrett	1 @ $800	800
Planer, 12"	1 @ $2,000	2,000
Bandsaw, 14"	1 @ $1,400	1,400
Jigsaw, 18"	1 @ $1,900	1,900
Jointer, 6"	1 @ $1,700	1,700
Wood Shaper	1 @ $2,900	2,900
Bench Saw, Tilting Arbor	1 @ $2,700	2,700
Armature Growler	2 @ $300	600
Electric Paint Blender	1 @ 300	300
Aircraft C-90-12 Continental Engine	6 $3,000	18,000
Aircraft 10346 Continental Engine	2 @ $1,000	2,000
Aircraft 470 Continental Engine	5 @ $2,500	12,500
Spot Welder, Portable	1 @ $700	700
Cabinet, Sand Blasting	1 @ $500	500
Machine, Sand Blasting	1 @ $500	500
Lathe, Metal, 13"	1 @ $5,400	5,400
Air compressor, 2-stage	1 @ $600	600
Vertical Mill	1 @ $4,400	4,400
Bandsaw, Wood and Metal	1 @ $1,400	1,400
Lab, Hydraulic	2 @ $900	1,800
Pitot Tester	2 @ $500	1,000

Work Bench, Steel Cabinet 12 @ $1,200	14,400
Sander, Belt and Disc Pneumatic 1 @ $2,100	2,100
Tester, Hardness 1 @ $500	500
Tester, Valve Spring 1 @ $350	350
Vise, Machinist 1 @ $300	300
Tube Bender, Heavy Duty 1 @ $700	700
Drill Press 3 @ $2,000	6,000
Cleaner, Ultrasonic 1 @ $500	500
Press, Hydraulic, 25 ton 1 @ $300	300
Furnace, Heat Treating 1 @ $2,450	2,450
Welder, Tig 2 @ $2,000	4,000
Crane, Portable Engine, Lifting 3-Ton 2 @ $300	600
Unit, Shelf Sloping 3 @ $300	900
Grinder, Pedestal 5 @ $800	4,000
Tool Cabinet, 3-Drawer Roll-Around 4 @ $730	2,920
Grinder, Bench 1/2 HP 4 @ $420	1,680
Grinder, Valve Seat 2 @ $4,000	8,000
Jack Set, Aircraft, 16,000 lb., 3-piece 1 @ $1,000	1,000
Jack Set, Aircraft, 6,000 lb., 4-piece 1 @ $1,000	1,000
Power Supply, Hydraulic, Cessna 300 PSI 1 @ $500	500
Grinder, Valve 1 @ $4,000	4,000
Demonstration Set, Pulley 1 @ $1,000	1,000
Degreaser 1 @ $750	750
Engine Model, 2-stroke 1 @ $400	400
Engine Model, 4-stroke 2 @ $400	800

Engine Model, Wankel	1 @ $400	400
Sander, Belt	2 @ $300	600
Storage Cabinet, 2-door	12 @ $300	3,600
Lathe, Armature	1 @ $500	500
Trainer, Hydraulic	1 @ $1,000	1,000
Trainer, Engine Oil System	1 @ $1,000	1,000
Test Stand, Aircraft Vacuum/Pressure	1 @ $500	500
Tester, Magnaflux	1 @ $5,000	5,000
Hacksaw, Metal Power Band	1 @ 1,800	1,800
Shear, Metal	2 @ $3,000	6,000
Former, Metal	1 @ $500	500
Crimper and Bender, Metal	1 @ $3,200	3,200
Riveter, Cherry Townsend	1 @ $400	400
Prop Balance Kit	1 @ $500	500
Test Stand, Prony Brake	1 @ $500	500
Trainer, Landing Gear	1 @ $800	800
Trainer, Steering Gear	1 @ $800	800
Trainer, Aircraft Generator	1 @ $300	300
Bin, Parts Storage	8 @ $350	2,800
Vise, Swivel Base	1 @ $300	300
Electrical Demonstration Unit	1 @ $1,000	1,000
Work Bench, Hardwood Top	2 @ $1,200	2,400
Welder, Gas	2 @ $400	800
Work Stand With Casters	5 @ $750	3,750
Stand, Test, Magneto	1 @ $1,000	1,000

Brake, Metal Bending	1 @ $500	500
Piper Apache Aircraft	1 @ $12,000	12,000
Aircraft Scales	1 @ $2,000	2,000
Filmstrip Projector With Sound	2 @ $340	680
Tool Set, 169-pieces	1 @ $750	750
Jet Engine Training Aid	2 @ $500	1,000
Micrometer Set, 0-6"	1 @ $300	300
Flaw Detector, Ultrasonic	1 @ $3,000	3,000
Piper Cub J3 Aircraft	1 @ $7,500	7,500
Propeller Protractor	1 @ $350	350
Projector, Caramate	2 @ $475	950
Jet Engine	2 @ $500	1,000
Micro-Fiche Reader Printer	1 @ $1,000	1,000
Engine Test Stand, Pratt & Whitney Turbo Prop PT6	1 @ $40,000	40,000
Nav/Comm/IIs Signal Generator	1 @ $750	750
Transponder/Dme Test Set	2 @ $10,495	20,990
Dme Interface Panel	2 @ $725	1,450
Transponder Interface Panel	2 @ $625	1,250
Communication Service Monitor	1 @ $8,175	8,175
ADF Test Panel	1 @ $679	679
Weather Radar Test Set	1 @ $16,995	16,995
Radar Test Control Panel AN-36	1 @ $780	780
Function Generator	1 @ $2,500	2,500
Digital Multi-meter	2 @ $369	738
Bench Test Set	2 @ $11,395	22,790

Isolation Amp Control Panel	1 @ $828	828
Nav/Comm Control Panel	3 @ $304	912
Glidescope Control Panel	1 @ $479	479
Area Navigation Control Panel	1 @ $729	729
Frequency Counter	2 @ $1,000	2,000
Oscilloscope AN69	2 @ $1,500	3,000
Oscilloscope AN70	2 @ $1,500	3,000
MKE/NAV/COMM G-S Simulator	1 @ $7,995	7,995
Transponder/DME Test Set	1 @ $4,995	4,995
Counter, With Fixtures (racks, hangers, glass case, shelving)	3 @ $3,000	9,000
Microcomputers, IBM-PS 30	11 @ $1,400	15,400
Cash Register	3 @ $800	2,400
Camcorder	1 @ $1,300	1,300
Videocassette Recorder	3 @ $300	900
TV/Monitor	3 @ $440	1,320
Copier	3 @ $1,995	5,985
Computer Printer	11 @ $450	4,950
Tool Cabinets	4 @ $1,300	5,200
Work Benches, Metal	10 @ $1,000	10,000
Work Benches, Standard	10 @ $800	8,000
Parts Cabinet	2 @ $1,019	2,038
Sheet Metal Rack	1 @ $500	500
Welding Tables, 3 Stations	1 @ $1,368	1,368
Cleaning Vat	1 @ $825	825

Welding Booth 2 @ $684	1,368
Table Top - Drafting 20 @ $350	7,000
Equipment Subtotal	$438,019

Supplies

Voltage and Amperage Tester 1 @ $150	150
Propeller, Wood, AU-205 1 @ $100	100
Electric Drill 1/2" 2 @ $175	350
Valve Installer Set, Burroughs 1 @ $100	100
Screw Plate Set 1 @ $100	100
Pneumatic Rectangle Polisher 2 @ $150	300
Pneumatic Grinder, 7" 4 @ $225	900
Impact Wrench, Pneumatic 1/2" Drive 1 @ $175	175
VOM Tester 8 @ $120	960
Lapping Plate 18" Round 1 @ $100	100
Surface Plate, 16" x 24" 1 @ $240	240
Pneumatic Drill, Heavy Duty 1 @ $200	200
Compression Riveter 2 @ $150	300
Fire Extinguisher, CO2 50# 5 @ $50	250
Generator-Alternator Test Stand 1 @ $150	150
Torque Tester, 10-150 Pound 1 @ $100	100
Torque Tester, 50-500 Pound 1 @ $100	100
Metal Pneumatic Shear 2 @ $200	400
Vacuum Cleaner 1 @ $150	150

Overhead Projector	6 @ $190	1,140
Reamer Set	1 @ $200	200
Strut Pump	1 @ $200	200
Control Cable Tensionmeter	1 @ $250	250
Aircraft Tow Bar	1 @ $50	50
Battery Charger 12-24 V	1 @ $175	175
Paint Sprayer	5 @ $125	625
Spark Plug Tester	2 @ $100	200
Gap Setting Tool	1 @ $10	10
Thermometer Tester	2 @ $85	170
Spark Plug Tap Set	1 @ $100	100
Piston Ring Compressor Set	1 @ $25	25
Hydraulic Valve Lifter Tester	1 @ $100	100
Deburring Pneumatic Tool	2 @ $175	350
Cylinder Hold-Down Fixture	1 @ $88	88
Valve Guide Remover & Replacer	1 @ $200	200
File Cabinet, 4-Drawer	12 @ $100	1,200
Guimont Borescope	1 @ $200	200
Piston, Time Rite Indicator	2 @ $200	400
Air Drill 1/4"	6 @ $175	1,050
Sheet Metal Vise	6 @ $230	1,380
Engine Stand, Radial	1 @ $200	200
Airtool Control	1 @ $100	100
Metal Nibbler	1 @ $180	180
Aircraft Jack, 6,000 lb.	1 @ $200	200

Bench Vise, 4" Jaw	1 @ $275	275
Valve Housing Wrench	1 @ $100	100
Retaining Nut Prop Wrench	2 @ $100	200
Piston Dome Removing Tool	1 @ $200	200
Arbor Press, 10-Ton	1 @ $250	250
Storage Shelves	6 @ $200	1,200
Welding Torch	10 @ $175	17,500
Aligner Rod	1 @ $100	100
Engine Case Tap Set	1 @ $125	125
Cylinder Stud Tap Set	1 @ $125	125
Cylinder Hone	1 @ $50	50
Machinist Vice, 4" Jaw	14 @ $250	3,500
Hand Riveter	6 @ $35	210
Valve Seat Remover	1 @ $50	50
Flexible Hone Kit	1 @ $75	75
Router, 1 HP	1 @ $150	150
Torque Wrench	2 @ $100	200
Float Valve Remover	1 @ $50	50
Magneto Synchronizer	1 @ $250	250
Standard Puller Set	1 @ $75	75
Compression Tester	1 @ $25	25
Multimeters	12 @ $30	360
Olympic Pulling Head	2 @ $200	400
Watt Meter	2 @ $75	150
Power Supply	8 @ $280	2,240

Assortment of Resistors, Capacitors, Inductors and Semi-Conductors	
1 @ $500	500
File Cabinets	
9 @ $100	900
Cassette Tape Player	
1 @ $135	135
Storage Cabinets	
8 @ 286	2,288
Stools	
80 @ $50	4,000
Airframe Maintenance Technology:	
Specialized Hand Tools	
12-Station Lab @ $2,000/Station	24,000
Metal For Construction and Repair of Airframe	2,080
Assortment of Parts	
100 students @ $120	12,000
Welding Rods, Spark Plugs, Rivets	
100 students @ $35	3,500
Training Manuals and Supplementary Books	
100 students @ $30	3,000
Avionics:	
Specialized Hand Tools	
10-Station Lab @ $2,000/Station for Assortment of Tools	20,000
Avionics Instructional Kits	
32 @ $250	8,000
Avionics Mock-Ups (Simulated Electronics Components)	
50 students @ $200	10,000
Training Manuals and Supplementary Books	
50 students @ $100	5,000
Pilot Training:	
Maps, Small Hand Instruments, Flight Calculators, Pilot Calculators	
25 students @ $800	20,000
Flight Simulation Software	
12 Programs @ $250	3,000
Training Manuals and Study Guides	
25 students @ $100	2,500
Customer Services:	
Steamer	100
Tagging Equipment	50
Manuals and Supplemental Books	
100 students @ $30	3,000

Computer Software	
25 Programs @ $200	5,000
Merchandise for Lab (Tickets, Pamphlets, etc.)	1,000
Office Supplies	
10 months @ $150	1,500
Tools (Assorted Hand Tools)	
100 students @ $90	9,000
Air Traffic Control:	
Training Manuals and Study Guides	
50 students @ $100	5,000
Travel and Tourism:	
Computer Software	
50 Programs @ $200	10,000
Manuals and Study Guides	
75 Students @ $30	2,250
Travel Agency Simulation Materials (Tickets, Pamphlets, Maps)	
75 students @ $20	1,500
Supplies Subtotal	$201,081

Contractual

Contract with Butler Aviation to provide flight training program in the area of fixed base operations	
100 students x 6 days @ $40	24,000
Contractual Subtotal	$ 24,000

Other

Telephone	
3 phone x 1 year @ $960/year	2,880
Postage	
12 months @ $30	360
Photocopying/Duplication (Brochures, Correspondence)	
12 months @ $50	600
Promotion/Recruitment Activities	
Television Announcements - Cable Weather Channel	
150 times a week x 4 weeks @ $10/week	40
Radio Announcements	
10 times a week x 4 weeks @ $500/week	2,000
Billboards	
12 locations x 1 month	5,000

Student Activities: Shadowing Experiences at Airports & Travel Agencies	
400 students @ $5	2,000
Curriculum Development and Integration of Aviation Into Existing Curriculum	
12 teachers x 20 hours @ $11/hour	2,640
Staff Training	
20 teachers x 18 hours @ $9/hour	3,240
After-School Enrichment Activities	
400 students x 30 days @ $5/day	60,000
Summer Program	
400 students x 15 days @ $10/day	60,000
Other Subtotal	$138,760
GRAND TOTAL	$1,104,111

BUDGET JUSTIFICATION

Aviation Magnet High School

1. Personnel

This program will require the addition of certified teachers who have special training and certification (FAA, FCC, pilot's license, etc.). Teachers are also needed to develop the aviation curriculum, to integrate aviation into the existing high school curriculum, to act as a liaison with the many collaborating community agencies, to respond to prospective students and their parents, and to work with the middle schools in recruitment activities.

2. Equipment

The equipment for this program is highly specialized. it has been selected on the basis of recommendations from local aviation authorities to ensure that industry standards are maintained and the students will obtain the marketable skills needed for FAA certification and other employment/licensing.

3. Contractual

The experience of working in a fixed based operator setting cannot be simulated realistically or cost-effectively in a classroom. Therefore, the project will contract with a local aviation company to provide this experience for the students.

4. Other

Because this program will be academically demanding and because students can be expected to need extra support to prepare for real job vacancies in the aviation field, each student will receive after-school assistance/tutoring/counseling once a week to meet individual needs. During the summer, students will participate in a three-week on-site internship in the aviation areas in which they are training, thereby linking classroom knowledge to the job market.

By mid-1993 Shawnee High School was meeting objectives set forth during the early planning stages of their magnet programs. Students choosing the Shawnee High School Aviation Magnet program have the opportunity to train in either aviation or travel and tourism.

PRESENT SHAWNEE AVIATION PROGRAM

TRAVEL AND TOURISM

Students participating in Travel and Tourism have comprehensive exposure to state-of-the-art reservation systems, leading to certification on systems made available to students through the major airlines and travel agencies. In a complete travel agency environment, students receive hands-on instruction and have the opportunity to become associated with the American Society of Travel Agents (ASTA). Upon completion of the program, students are knowledgeable in all aspects of travel agency management and marketing of the tourism industry.

Customer Services

Students participating in the Customer Services component of the Aviation Program have comprehensive exposure to the varied support services of the aviation industry. Emphasis is placed on the development of personal skills required for successful employment in servicing the public. Technical training in on-site industry environments, as well as laboratory settings, is incorporated where appropriate. Students completing this component of the Aviation Program are fully prepared for employment in their area of specialization. Areas of specialization include: Flight Attendant, Ticket/Ramp Agent, Car Rental Agent, Gift Shop Operation, Skycap.

Flight Training

Students participating in Flight Training have the opportunity to earn a Federal Aviation Administration (FAA) Certified Pilot's License. The program includes comprehensive ground instruction, training in one of Shawnee's two, full-motion flight simulators, and flight in actual airplanes based at Bowman Field.

AVIONICS

Students studying Avionics have the opportunity to earn a Federal Communications Commission (FCC) License. The program includes hands-on experience with installation, trouble-shooting and repair of aircraft instruments, radios and electronic equipment required for flight.

AIR TRAFFIC CONTROL

Students participating in the Air Traffic Control component of the Aviation Program have comprehensive exposure to preparatory information included on the Air Traffic Control Written Examination. Development of communication skills that are vital to qualify for selection as an Air Traffic Control Specialist candidate is emphasized in a laboratory setting. Training includes the utilization of computerized, voice-activated radar simulation systems.

FACILITIES

Shawnee High School is a unique blend of the old and the new. With over 333,000 square feet of floor space on 16 plus acres, Shawnee is the largest high school in Jefferson County.

In addition to the newly air-conditioned, traditional classrooms, the Shawnee facility contains three, full-class computer labs and several smaller labs - each offering a variety of computer experience (in excess of 140 computers throughout the school); chemistry-physics-biology labs; two auditoriums (one with the seating capacity of 1600 and a full, professional stage; the other seating 250 for guest speakers); two complete gyms (one is stadium style); a football field and track; a 50-meter Olympic-size indoor swimming pool; a Navy Junior ROTC wing complete with the best rifle range in the state; and a college room with a career placement computer and SAT/ACT preparation.

Another outstanding component of the Shawnee complex is the Aviation wing that was added in 1989 through total renovation of the south wing of the school. This special area houses the optional school programs for Travel and Tourism (with a Travel Agency containing reservation computers for training), Customer

Services (with a cash register lab and gift shop), Flight Training (having two, full-motion flight simulators), Avionics (with lab), and Air Traffic Control (with 6 ATC simulation computers); Aircraft maintenance shops exist and will be used when the FAA gives final approval for the program. An aircraft hangar is on the Shawnee campus, housing two planes belonging to the school.

These facilities allow Shawnee to offer a more diverse and fulfilling educational plan, serving to enhance both the academic and extra-curricular programs at Shawnee High School.

TRAVEL/TOURISM COMPONENT - FOUR YEAR PLAN

Grade 9
English: E101/E100/ECE
Math: X101, General Math (X100/X200), ECE
Science: C105, ECE
Health/P.E.: P101/P100
Geography: S200
Intro to Aviation: K1M0, First Semester
Intro to Customer Service: K1M5, Second Semester

Grade 10
English: E201/E200/ECE
Math: X102/General Math/ECE
Science: C201/ECE
Keyboarding: B200
Foreign Language: F1S0/F1F0 or General Business
Travel Tourism Marketing: K2M6

Grade 11
English: E300/E301/ECE
Math: X302/General Math/ECE
Science: C300/C303/ECE
U.S. History: S301/S300/ECE
Language/Business Education Electives continued
Domestic/International Sales, K3M6 (K316)

Grade 12
English: E401/E400/ECE
Math: Elective
Science: Elective
Humanities: U400
Travel Agency Co-op, 3 Class Hours, K4M6

CUSTOMER SERVICE COMPONENT - FOUR YEAR PLAN

Grade 9
English: E101/E106/ECE
Math: X101/General Math (X100, X200), ECE
Science: C105/ECE
Health/P.E.: P101/P100
Geography: S200
Intro to Aviation: K1M0, First Semester
Intro to Customer Service: K1M5, Second Semester

Grade 10
English: E201/E200/ECE
Math: X102/General Math/ECE
Science: C201/ECE
Keyboarding: B200
Foreign Language: F1S0/F1F0 or Business Education
Customer Service Marketing: K2M5

Grade 11
English: E300/E301/ECE
Math: X202/General Math/ECE
Science: C300/C303/ECE
U.S. History: S301/S300/ECE
Language/Business Education/Electives continued
Sales Technology: K3M5 (K315)

Grade 12
English: E401/E400/ECE
Math: Elective
Science: Elective
Humanities: U400
Opportunities Management (Co-op), 3 Class Hours, K2M5

It is clear that a program like Shawnee High School's Aviation Magnet offerings cannot succeed without extensive cooperation from the business community in the area.

SHAWNEE'S CORPORATE/BUSINESS INVOLVEMENT

Some of the key areas of cooperation and support currently being made available to Shawnee's students include:

United Parcel Service (UPS)
Delta Air Lines Inc.
SABRE - American Airlines
Northwest Airlines
Travel Professionals International Inc.
TravelPlex
Embry Riddle Aeronautical University
Jefferson Community College
Derby Festival Committee
SKYCARE
Louisville Convention & Visitors Bureau
The Kroger Company
Winn-Dixie
Capital Holding
A.D. Porter and Sons
Citizens Fidelity, Shawnee Branch
Liberty National Bank & Trust Company of Louisville

Butler Aviation Louisville Inc.
Bowman Field Air Traffic Control Tower, Flight Services
Regional Airport Authority

Clearly, any school system planning an aviation magnet high school program would do well to examine the planning process used in developing the Shawnee High School program.

"If your current programs, such as your aerospace technology programs, are high school programs, what are you doing to be sure that students are receiving the quality of instruction in lower grades to prepare them to successfully pursue the programs that you are designing and implementing?"

Alicia Coro

SECTION VII - SELECTED EXAMPLES OF AVIATION/AEROSPACE EDUCATION PROGRAMS

Many educational leaders are building partnerships with other schools, colleges, technical institutions and local industries using aviation and related technologies. Following are illustrative examples of such programs. Many of them use different approaches and some have many characteristics and practices in common. Studying them may help another community establish a similar program. Naturally, not all communities have identical aviation, aerospace, transportation and related services, needs and employment opportunities. However, there are growing local, state, regional, national and international needs for highly motivated, well trained and educated employees with skills needed in our increasingly complex world.

Whether preparing for a career or increasing the ability to understand and function in an aerospace age, the following programs provide ideas for duplication in other communities.

MINUTEMAN/EAST COAST AERO TECH PARTNERSHIP CREATES HIGH SCHOOL AEROTECHNOLOGY PROGRAM

(Gene Santoro is the coordinator of this program which is part of the Minuteman Regional Vocational Technical School District of Lexington, Massachusetts.)

East Coast Aero Tech and Minuteman Regional Vocational Technical High School, with the approval of the Federal Aviation Administration, Wentworth Institute of Technology,and the Massachusetts Department of Education, have formed a partnership. Minuteman and East Coast have designed a program for eighth graders entering their freshman year of high school. This unique program is designed to accelerate students through high school academics and propel them into an aircraft maintenance career. Students who wish to continue their education in engineering or other areas may enter a two or four year college with advanced credit. This program is designed for students who want to learn through applied methods, who want to excel, and who want to enter a field that demands high standards. The content of the academic program has been intensified and includes math, science and communications skills important in the aerotechnology field.

Freshmen and sophomores from outside the Minuteman District may also enter the new program; this is possible by transferring into the program from other schools. Entry into the program depends on what academic subjects, such as algebra, English and science, have been taken or what arrangements Minuteman's guidance staff can make with the new student to ensure eligibility.

Minuteman Regional Vocational Technical High School is a 1,000 student science-technology school located in Lexington, Massachusetts. Minuteman opened its doors in 1974 and now serves 16 towns, including: Acton, Arlington, Belmont, Bolton, Boxborough, Concord, Carlisle, Dover, Lancaster, Lexington, Lincoln, Needham, Stow, Sudbury, Wayland and Weston.

Minuteman operates on a week-about schedule. Students attend one full week (30 hours) of academics followed by one full week of laboratory. Minuteman offers 22 different technical majors. Minuteman is a progressive institution and is staffed by teachers who are trained to integrate academics and applied material. Each department is equipped with "competency based" curriculum designed to accommodate students with varying learning styles or preferences. All instructors use "Total Quality Management" procedures to prepare students for a highly competitive job market.

East Coast Aero Tech (ECAT) is an airplane maintenance school located in Lexington next to Bedford Airport and Hanscom Air Base. ECAT is owned by Wentworth Institute of Technology. ECAT is a landmark in the area and has been around for many years. Their TV commercial is as well known to the public as their quality graduates are to commercial, corporate and private airlines. ECAT's program is made up of ten 36-day phases which include classroom and hands-on instruction needed to prepare students to take the Airframe and Powerplant (A&P) exam. The A&P exam is necessary in order to receive the A&P licenses from the Federal Aviation Administration (FAA).

The Massachusetts Department of Education (DOE) recently approved the program designed by Minuteman and ECAT. The DOE approved the program and labeled the department "Aerotechnology" which will produce Aerotechnology Technicians. The program has been referred to as the "Vertically Accelerated Program" (VAP) because it is designed for students who have a need to be academically challenged. The new program offers students who have completed the eighth grade the opportunity to come to Minuteman as Freshmen, select the VAP, finish the academic program in three years and spend their senior year at ECAT free of charge. All students entering the program will save half of the ECAT tuition.

Students who complete the Minuteman VAP and ECAT programs will receive a Minuteman High School diploma (and possible certification in one of 22 different shop majors), an ECAT diploma, certification to take the FAA A&P exams and 48 college credits recognized by Wentworth Institute of Technology (WIT).

ECAT graduates are eligible to earn 24 college credits by entering WIT for an Associates Degree in "Aircraft Maintenance Technology" or 46 college credits by entering the Associates Degree Program "Applied Science in Aeronautics Technology." WIT is also offering ECAT graduates four Bachelor of Science Degree Programs: "Airway Science-Aviation," "Manufacturing," "Mechanical Engineering Technology," and "Technical Management."

CENTER FOR HIGH TECHNOLOGY - ROANOKE, VIRGINIA

(Lloyd W. Enock, Director, Business & Technical Education, Roanoke city Schools is responsible for this program.)

Purpose

Magnet programs are designed to draw students from Roanoke and the surrounding area to schools where particular themes are emphasized.

Who May Apply

All students entering grades 6-12 from the Roanoke Valley and surrounding areas are eligible to attend. There is no tuition charge. Grades, attendance and behavior factor into the decision processes. To balance racial and gender percentages, numerical guidelines will affect the number, race and gender of students accepted into the program.

Programs

Exciting opportunities await any student accepted into the Center for High Technology at both the middle and high school levels. The Center for High Technology at the middle school level is located at William Ruffner. The program consists of a one or two hour block in the Lab 2000, during which students explore many aspects of technology including:

- electronics
- robotics
- communications
- aerodynamics

The Center for High Technology, located in the Lawson Center at William Fleming High School, consists of six separate programs. They are:

- Architectural and Engineering Design Technology*
- Television and Video Production
- Computer Science Technology

- Graphic Arts and Design
- Aeronautical Science Technology*
- Technology 2000 (for 9th graders located at William Ruffner)

*Dual enrollment course - college credit can be earned.

All programs feature state-of-the-art equipment. Every effort is made to evaluate curricula to insure that the content is coordinated with college level programs. Internships with local employers allow students to learn in a professional environment. In addition, employer and community involvement add reality to the program and allow for practical application of knowledge and skills learned at school. Each program, at both middle and high school levels, has an advisory council, comprised of professionals from the valley, who assist with curricula development.

Middle School Level Center For High Technology Lab 2000

Facilities

Located in the School of Arts Building at William Ruffner Middle School, the Center for High Technology Lab:

- contains the LAB 2000, a synergistic approach to teaching technology.
- is computer-centered. IBM, Apple and MacIntosh computers are used for a variety of activities.
- has a wind tunnel for testing various models and an airfoil to determine aerodynamic capabilities.
- contains a CNC machine which, when used with a computer, can mass produce products, for example, 25 identical candle holders.
- studies hydroponic gardening - growing and maintaining flowers and vegetables using the latest advances in farming techniques.
- has a robot that is programmable and capable of repeating a variety of operations.

Program

State-of-the-art equipment and techniques are used to keep students on the "cutting edge" of technology. The six elements of technology are studied and related to each of the courses. The elements are: energy, processes, humans, information, materials and tools.

Sixth Grade

"Explorations in Technology" is a class which is the student's first exposure to technology. Each student will experience activities centered around three technology "islands" which relate to transportation, production and communications. Students will cooperate and work with each other in small groups to complete a variety of activities and solve problems.

Seventh Grade

"Elements of Technology" broadens the student's understanding of three important areas of modern technology - transportation, production and communications. Computer simulation programs will help students explore the world of robots, rockets, flight, car building, etc. Students will plant, monitor and care for a variety of flowers and vegetables in hydroponic gardens. Students will work with each other in small groups as they complete the activities and solve assigned problems.

Eighth Grade

"Technology Systems" will expand the student's knowledge of transportation, production and communications through activities which challenge creativity and bring meaning to the term "systems." Throughout this course, students will work together to complete the activities and solve problems.

High School Level   Center for High Technology

Aeronautical Science Technology includes instruction in ground and flight training. Upon completion of ground school, the student will take the Private Pilot Written Examination administered by an agent of the Federal Aviation Administration (FAA). The flight training student will report to the Roanoke Regional Airport for in-aircraft training.

Features

- An FAA-approved GAT-1 full motion flight simulator is used to familiarize students with instrument and flight control.
- Aircraft owned and operated by Roanoke City Public Schools are used for pilot training.
- Supervised internship programs in the field of aviation are available to students.

Architectural Engineering Design Technology uses computer aided drafting and design (CADD) programs in various engineering design and architectural projects. Students begin by learning basic drafting and design techniques then progress to developing new CADD skills by creating various engineering drawings. Upon completion of this program students will be qualified to enter the work market where the CADD system is utilized or enter a college to study architecture and/or engineering.

Features

- IBM PC computers and AutoCad, the number one design software used in the field, are integral parts of the course.
- Students will draw a set of house plans using CADD.
- Students may be able to receive college credit for some of their coursework.

Computer Science Technology begins by introducing students to computers and related technologies. Topics covered include computer animation and graphics and programming in Turbo Pascal, Artificial Intelligence, BASIC and Assembly languages. Interfacing robots to the computers is emphasized.

Application programs are LOTUS 1-2-3, dBase III Plus, and desktop publishing using Pagemaker. Every student will learn the use of an integrated package including word processing, database, spreadsheet and graphics.

Features

- IBM System II Model 30 and Model 50 computers and a modem are available to students.
- Teachers use the latest software.
- Students may be able to receive college credit for some of their coursework.

HIGHLAND SPRINGS TECHNICAL CENTER - HIGHLAND SPRINGS, VIRGINIA COUNTY PUBLIC SCHOOLS

(Richard L. Upchurch, Aviation Programs Supervisor provided this information.)

Our programs at Highland Springs Tech Center include pilot training and technician courses for all of our county's eight high schools, a summer program for middle school students, and adult programs in both private pilot ground school and GAT-1 simulator training.

Summer Workshop

This program started primarily for late middle and early high school students (grades 8, 9, 10) to explore aviation mechanics and pilot training. It allows them to take a quick look at both programs in a "hands-on" oriented two week session. The class meets immediately after the close of the regular school year in June from 8:30 a.m. to 12:00 noon, Monday through Thursday.

Students learn to do minor preventative maintenance on the Cessna 150 and Hughes "helo" in our Tech Lab. They also learn basic aerodynamics and navigation, career opportunities, Morse code and build balsa wood gliders for competition. They have one orientation flight in a Piper Warrior where each student is at the controls for about 3-4 miles of taxi practice and while airborne on a short flight. This program has been very successful. The kids complain that the course is too short.

Pilot Training Internship/Shadowing Program

This program was developed for second year pilot training students. Eleven agencies at the Richmond International Airport are involved in taking all of our flight students for 10-20 hours of interning on a rotating schedule during the school year. They are: Virginia Department of Aviation, Air National Guard, Army Aviation National Guard, ATC (Tower), ATC (RAPCON), Richmond Airport Commission, Virginia Aviation Museum, Delta Airlines, Aero Industries (FBO), National Weather Service and the FAA Flight Standards District Office (FSDO) for Richmond.

Students are taken under the wing of a professional and shown the routine of that particular occupation. It is very successful and both the agencies and the students are pleased with its results.

The daily routine for our second year flight students is a three hour block each afternoon. Depending on their scheduled activity they may be on an instructional flight, solo flight, doing simulator work or classwork in the Aviation Lab, at their internship training, or on a charter flight with the FBO contracted for our flight instruction. They are given considerable responsibility as they go directly to their scheduled event and if it is other than at the Lab, they report by phone when they arrive at their assignment to the Aviation Lab Instructor for attendance.

KENT COUNTY VOCATIONAL TECHNICAL SCHOOL DISTRICT AVIATION PROGRAM - WOODSIDE, DELAWARE

(Harry J. Batty, Jr., Aviation Teacher provided this information.)

Polytech's Aviation program started in October, 1992 by offering the program to students already enrolled at Polytech. Next year the program will be a stand alone program with students dedicated specifically to aviation.

Polytech's Aviation program starts off with 9th grade students receiving a taste of the program through an exploratory program which exposes 9th graders to the numerous vocational fields at Polytech. Students select a vocational field near the end of their freshman year. In 10th grade, aviation students receive a comprehensive ground school course in preparation for taking the FAA private pilot written test. 11th grade students take flight training in preparation for their private pilot's license. 12th grade students further their training by completing their private pilot licensing requirements and specializing in an area within the aviation career field. Throughout the program guest speakers and tours of aviation facilities are provided to stimulate students' knowledge in this career field.

Polytech's Aviation program is unique in that it ties aviation-related materials in with other academic subjects through our cluster system. Polytech's Aviation program is also unique in that it is one of the few high school aviation programs allowing the 1993 student to receive a private pilot's license prior to high school graduation. The program has a broad focus with students receiving an aviation education that examines a wide spectrum of aviation career fields including Air Traffic Control, Avionic Technicians, A & P Mechanics, Flight Safety and Flight Programs. Our program encourages enrollment in the Civil Air Patrol and is also affiliated with Opportunity Skyway. We hope to soon purchase a GAT-1 simulator and we are looking forward to continued program expansion.

Additional details of the program are published in a handbook for prospective students. It states, in part:

Aviation

Course Content: This new exploratory course is designed for students who are interested in learning more about aviation. The course starts with a comprehensive ground school program designed to broaden the student's knowledge of aviation and to prepare him/her to pass the Federal Aviation Administration's Private Pilot Written Examination. The student continues to expand his/her knowledge and expertise in aviation with actual flight training, culminating with a private pilot's license.

Related College Studies: Two-year technical degree in Aeronautical Science Technology. Four-year degree in Airway Science and Aviation Management.

Typical Jobs: Flight Instructor - Flight Schedule Coordinator - Airframe and Powerplant Mechanic - Apprentice Flight Dispatcher - Flight Engineer - Air Traffic Controller - Avionics Technician - Ground Attendant - Pilot.

Comments: You will receive a comprehensive ground school program which includes the Jeppesen/Sanderson Private Pilot Course, computer studies and simulations (in addition to visits to Dover

Air Force Base, Flight Safety, local airports, aircraft repair facilities and local aviation related industries). Guest speakers from the military, FAA, aerospace industries and the airlines are also an integral part of the program. The program's ties with the Civil Air Patrol and Opportunity Skyway afford many opportunities to further expand your knowledge in this exciting career field. Students take orientation flights their first year in the program and begin flight training during their second year.

SOUTHSIDE CENTER FOR APPLIED TECHNOLOGY - LEXINGTON, KENTUCKY

(Information provided by Wayne King, Program Coordinator.)

Wayne King has provided some practical suggestions for anyone planning to start an aviation program based on his experience.

1. Start an advisory committee from the local community for support and advice for the program.
2. Use the committee to help decide what curriculum is to be used.
3. Set decisive goals and a timetable for completion of items like:
   a. when to hire an instructor.
   b. what text(s) to use.
   c. are you going to teach exploratory aviation or an FAR Part 147 Maintenance Technician program or an FAR Part 141 Flight program?
4. Have the school board backing, with an understanding of what you desire the program to involve. (This has been a problem when it comes to flying and funding for us.)
5. Try to use and modify as much curriculum as you can find to start.

In the Aviation Technology program taught at the Southside Center, students attend the specialized aviation career-oriented classes three class periods each day. The remaining three class periods are spent at the student's home school.

Goals

1. Provide students with knowledge and experiences that will enable them to make appropriate decisions regarding the next level of education and training toward a career in aviation or a related field.
2. Students will achieve selected competencies aimed at meeting some of the initial entry requirements for certain aviation careers.
3. Provide students with key knowledge and skills that, although acquired in aviation related study, will apply to

other career areas within the work force.

4. Emphasis is on teamwork, excellence in workmanship, excellence in effort and excellence in overall achievement. There are high expectations of all students.

Objectives

Objectives of the program are to enable students to:

1. Develop a fundamental understanding of the various systems and components of an airplane and how they interact.
2. Develop a knowledge of the career opportunities within aviation and related fields plus the educational and certification requirements. (This includes, within its scope, the opportunities within an overall airport authority.)
3. Develop a knowledge of the agencies and institutions through which education for aviation and related careers might be pursued.
4. Apply academic learning in the pursuit of knowledge and skills aimed at a career goal in aviation or a related field.
5. Acquire certain fundamental technical knowledge and skills that will be useful in an aviation maintenance technician training program.
6. Acquire knowledge and understanding of ground school topics sufficient to pass the FAA exam.
7. Solve complex technical problems involving lab/shop activities that require the application of knowledge and skills in mathematics, science and communication processes (written and verbal).
8. Develop certain fundamental knowledge and skills in the safe use of a variety of materials, processes, tools and machines.
9. Conduct research and the preparation of a written report pertaining to a problem and/or issue relevant to aviation or a related field.
10. Apply computer technology in the solution of problems unique to the aviation industry.

Curriculum Categories

1. Career Paths and Training Requirements
    a. Career exploration
    b. Education and training sources

2. Aircraft Theory and Practice Introduction
    a. Flight theory
    b. Nomenclature
    c. Flight controls
    d. Construction designs

3. Aircraft Systems
    a. Airframe
    b. Powerplant
    c. Instruments
    d. Landing gear
    e. Communications
    f. Avionics

4. Ground School (Preparation for FAA exam)
    a. Meteorology
    b. Navigation
    c. Controlled airspace
    d. Maneuvers
    e. FARs
    f. Communications
    g. Flight planning
    h. Aircraft performance
    i. Other

5. Aircraft Maintenance, Service and Repair
   Disassemble, inspect, service and/or repair and reassemble major components of the various airplane systems.

6. Aircraft Design and Performance
   Design and perform experiments regarding airfoil design, weight and balance, positive and negative loading on a variety of wing designs.

Student Admission

Students who will become seniors in the upcoming year receive first priority for admission into the aviation technology program. Acceptance is based upon the following criteria:

1. Good record of school attendance.
2. At least average but preferably strong academic performance record.
3. Strong interest in aviation as a possible career area.
4. Good work habits.

Interested students complete an application. The staff reviews each application and, assuming the above criteria are met, the number of students approved from each high school will be based on the proportion of the total high school enrollment to the overall high school enrollment in the school district.

Note: Courses such as engineering drafting (including AutoCAD proficiency), physical science, algebra, English composition and technology education emphasizing the use of tools, materials and equipment are important to the aviation technology curriculum.

Anyone planning a similar applied aviation technology program may benefit by communicating with Mr. King and his colleagues. They have developed detailed tasks and competencies students must demonstrate for each area of their curricular offerings. Similar task identification and performance requirements are shown in the next aeronautical technology program description.

WEST COUNTY TECH - ST. LOUIS, MISSOURI AERONAUTICAL TECHNOLOGY PROGRAM

(Information provided by Mr. Rick Deppe, Administrator Business, Industry and Adult Education.)

This two-year high school aeronautical technology program is part of the Special Experience School District of St. Louis County. As Mr. Deppe has pointed out:

> "In Missouri, our program is not defined as a "magnet." However, we serve and can enroll high school students from the surrounding twenty-three (23) school districts in St.Louis County and the St. Louis City District."

All of the funding for this program is provided jointly by the state and local government. Below is a description of the four semester Aeronautical Technology program.

AERONAUTIC TECHNOLOGY

Program Description: Aeronautical Technology is a two-year program designed to help students learn basic skills in maintenance engineering or commercial flight. In the first year students learn the theory of flight, basic riveting, fabric application/repair, engine disassembly/reassembly and automatic flight control systems. In the second year students specialize in sheet metal, composite construction, and corrosion control.

Prerequisite Course(s): None

JUNIOR

Period	Semester 1	Semester 2
1	Aeronautical Technology	Aeronautical Technology
2	Aeronautical Technology	Aeronautical Technology
3	Aeronautical Technology	Aeronautical Technology
4	American History 1	American History 2
5	Applied Mathematics 1	Applied Mathematics 2
6	Principles of Technology 1	Principles of Technology 2
7	Communications 1	Communications 2

SENIOR

Period	Semester 1	Semester 2
1	Aeronautical Technology	Aeronautical Technology
2	Aeronautical Technology	Aeronautical Technology
3	Aeronautical Technology	Aeronautical Technology
4	Communications 3	Communications 4
5	Applied Mathematics 3	Applied Mathematics 4
6	Principles of Technology 3	Principles of Technology 4
7	Elective	Elective

As in the Southside Center program described above, these courses have fifteen (15) duty categories to study and in which to demonstrate competency. Collectively, these make up the scope and the sequence of the two-year curriculum.

The following duties are associated with this program area:

A. Airframe Wood Structures
B. Fluid Lines and Fitti[illegible]s
C. Aircraft Sheet Metal
D. Aircraft Composite Structures
E. Reciprocating Engines
F. Jet Engines
G. Basic Electricity/Electronics
H. Basic Radio Theory
I. Autopilot and Automatic Flight Controls
J. Pilot Technology
K. Weather Technology
L. Aerial Navigation
M. Aircraft Structural Repair (Sheet Metal)
N. Aircraft Structural Repair (Composite)
O. Corrosion Control

- Duty A - Airframe Wood Structures
  - Task: 001 - Make a shop sketch
  - Task: 002 - Construct a balsa wood model aircraft
  - Task: 003 - Rig a model aircraft
  - Task: 004 - Cover an airframe structure
  - Task: 005 - Finish a model aircraft and cover with dope and color coats

- Duty B - Fluid Lines and Fittings
  - Task: 001 - Construct a low pressure hose assembly
  - Task: 002 - Construct a high pressure hose
  - Task: 003 - Bend a tubing assembly
  - Task: 004 - Flare a tube
  - Task: 005 - Install flareless tubing fittings

- Duty C - Aircraft Sheet Metal
  - Task: 001 - Develop and layout a rivet pattern
  - Task: 002 - Remove and replace solid rivets
  - Task: 003 - Remove and replace special fasteners
  - Task: 004 - Bend sheet metal
  - Task: 005 - Construct a sheet metal surface

- Duty D - Aircraft Composite Structures
  - Task: 001 - Construct a structural jig
  - Task: 002 - Shape a styrofoam core
  - Task: 003 - Laminate fiberglass using resin

- Duty E - Reciprocating Engines
  - Task: 001 - Operate a model aircraft reciprocating engine
  - Task: 002 - Time a magneto to an engine
  - Task: 003 - Disassemble a reciprocating engine
  - Task: 004 - Check engine parts for critical wear

- Duty F - Jet Engines
  - Task: 001 - Simulate operation of a jet engine
  - Task: 002 - Disassemble a gas turbine engine

- Duty G - Basic Electricity/Electronics
  - Task: 001 - Construct simple DC circuits
  - Task: 002 - Measure current flow
  - Task: 003 - Construct simple AC electric circuits
  - Task: 004 - Troubleshoot DC electric circuits
  - Task: 005 - Troubleshoot an electronic circuit

- Duty H - Basic Radio Theory
  - Task: 001 - Construct a simple radio receiver
  - Task: 002 - Chart frequency ranges
  - Task: 003 - Check an emergency locator transmitter (ELT)
  - Task: 004 - Operate a walkie-talkie

Duty I - Autopilot and Automatic Flight Controls
  Task: 001 - Taxi and steer a model aircraft

Duty J - Pilot Technology
  Task: 001 - Identify major cockpit instruments
  Task: 002 - Perform a preflight inspection
  Task: 003 - Operate a c-line model aircraft in flight

Duty K - Weather Technology
  Task: 001 - "Read" Cloud Formations
  Task: 002 - Decipher U.S. Weather Service teletype reports
  Task: 003 - Determine the feasibility of a proposed VFR flight

Duty L - Aerial Navigation
  Task: 001 - Determine the minimum safe altitude for a planned flight path
  Task: 002 - Plot a flight course
  Task: 003 - Develop a flight log

Duty M - Aircraft Structural Repair (Sheet Metal)
  Task: 001 - Classify structural damage
  Task: 002 - Repair negligible damage
  Task: 003 - Repair by patching
  Task: 004 - Repair by insertion
  Task: 005 - Repair by replacement

Duty N - Aircraft Structural Repair (Composite)
  Task: 001 - Classify structural damage
  Task: 002 - Repair negligible damage
  Task: 003 - Repair by patching
  Task: 004 - Repair by insertion
  Task: 005 - Repair by replacement

Duty O - Corrosion Control
  Task: 001 - Select aircraft cleaning materials
  Task: 002 - Remove corrosion products
  Task: 003 - Repair corrosion damage
  Task: 004 - Restore protective coatings

As Mr. Deppe has written, the St. Louis program is designed:

> "... to provide students with an introduction to the field of aircraft maintenance and with specific skill training in 1) sheet metal structural repair, 2) composite structural repair, and 3) corrosion control.

Clearly, students who demonstrate the competencies to accomplish the fifteen (15) duty functions and fifty-seven (57) specific, measurable tasks have entry level skills that the aviation and aerospace industries are looking for in new employees. If a graduate of this program desires to go on after high school to an FAR Part 147 Aviation Maintenance Technology (AMT) program, he or she will have an excellent preparation for this important career field.

BOCES II SUFFOLK AVIATION ACADEMY - BROOKHAVEN TECHNICAL CENTER, BELLPORT, NEW YORK

(Information on this program has been provided by Victor R. Amoroso, Principal and Michael Weisz, Aviation Program Leader.)

The acronym BOCES stands for Board of Cooperative Educational Services. This organizational structure is used throughout New York state to deliver educational services, programs, studies especially in categories related to the world of work via preparation for careers.

This BOCES facility serves students from all twenty-six (26) school districts in Suffolk County. Students from outside Suffolk County may attend. The aviation programs are also open to adults who want to prepare for or refine skills in an aviation career.

Students spend 2 hours and 45 minutes at the Aviation Academy and the rest of the time is at their home school. Two full sessions are held each day - one in the morning and the other in the afternoon.

An added feature of this program is that several colleges with aviation programs give college credit to the high school students who graduate from the Aviation Academy if they enroll for collegiate level study.

Course Title: AVIATION CAREERS/PROFESSIONAL PILOT TRAINING

Course Description

The students will study aerodynamics, navigation, meteorology and air traffic control procedures. They will operate aircraft simulators as well as actual aircraft. All students will take the private pilot's written exam and complete flight training leading to the Private Pilot Certificate.

Course Content

Basic Sciences of Pre-Flight (Ground School)
Navigation and Related Mathematics
Aircraft Communications
Air Traffic Control
Science of Meteorology
Airport Design
Airplane Construction

Career Opportunities

A. Work
    Pilot
    Aircraft Dispatcher
    Air Traffic Controller
    Ground Instruction

B. Post-Secondary Education*
    Colleges offering Flight Science, e.g. Dowling College, Farmingdale, Embry-Riddle Aeronautical University, Florida Institute of Technology

*College Advanced Standing available for students in this program.

Supportive Course Requirements

Algebra, Earth Science

Second Year Option

Students who demonstrate the ability and have a strong desire to become professional pilots will be offered a second year program. The second year student will be given the opportunity to obtain a Private Pilot's License and work with local industry in an aviation-related capacity.

Student Information

Related Course: Aviation Mechanics
Cost: Equipment and study material - $35.00. An additional fee of approximately $10.00 to take the Private Pilot's Written Exam administered by the FAA.
Available to Grades: 11 and 12
Length of Course: 1-year and 2-year option (2nd year option based on performance and teacher recommendation).
Number of Credits: Four (4) per year
Location: Suffolk Aviation Academy MacArthur Airport

Course Title: *AVIATION MECHANICS (AIRFRAME) FAA CERTIFIED*

Course Description

This program is designed to teach students the technical skills required to become an "A" technician. Successful completion qualifies the graduate to take the written, oral and practical tests with the Federal Aviation Administration for the Mechanics Certificate Airframe. The skills and knowledge gained from the program are applicable to other maintenance industries and professions as well as aviation.

Course Content

General (400 hours):

Basic Electricity
Weight and Balance
Mathematics
Basic Physics
Mechanic Privileges & Limitations
Ground Operations & Servicing
Aircraft Drawings
Fluid Lines & Fittings
Maintenance Forms & Records
Maintenance Publications
Materials & Processes
Cleaning & Corrosion Control

Airframe (750 hours):

Wood Structure
Aircraft Covering
Aircraft Finishes
Sheet Metal Structures
Welding
Assembly & Rigging
Airframe Inspection
Fuel Systems
Electrical Systems & Avionics
Ice & Rain Control
Hydraulic & Pneumatic Systems
Cabin Atmosphere Control
Aircraft Landing Gear
Aircraft Instrumentation
Communication & Navigation
Position & Warning Systems
Fire Protection

Career Opportunities

A. Work
   Aircraft Crew Chief
   Airport Service
   Accessory Overhauler
   Soldering & Wiring
   Hydraulic Mechanic
   Ground Power Mechanic
   Armed Forces
   Nondestructive Testing
   Sheet Metal Specialist
   Airframe Mechanic
   Aircraft Welding Specialist
   Aircraft Electrical Tech.
   Electrical Systems Testing

B. Post-Secondary Education
FAA Aircraft Technology for Air Frame
Powerplant Technician
Electronic Technology
Military Training

Student Information

Cost: Uniforms approximately $35.00, tools and books - $140.00
Available to Grades: 11 and 12
Length of Course: 2-year (and summer segment)*
Number of Credits: Four (4) per year
Location: Suffolk Aviation Academy MacArthur Airport

*A student must complete a 6-week post-graduate summer segment in order to obtain the 1150-hour requirement for FAA certification. Tuition and costs for this summer session must be paid by the student. College advanced standing is available.

Course Title: AVIATION MECHANICS (POWERPLANT)

Course Description

Aviation Mechanic students learn to disassemble and assemble aircraft engine components and test their operations. The powerplant segment has not yet been certified by the Federal Aviation Administration.

Course Content

General:

Basic Electricity
Weight and Balance
Mathematics
Basic Physics
Mechanic Privileges & Limitations
Ground Operations & Servicing
Aircraft Drawings
Fluid Lines & Fittings
Maintenance Forms & Records
Maintenance Publications
Materials & Processes
Cleaning & Corrosion Control

Powerplant:

Reciprocating Engines
Turbine Engines
Engine Inspection
Engine Instrument Systems
Fire Protection Systems
Electrical Systems
Lubrication Systems
Ignition Systems
Fuel Metering Systems
Engine Fuel Systems
Induction Systems
Engine Cooling Systems
Engine Exhaust Systems
Propellers

Career Opportunities

A. Work
- Aircraft Crew Chief
- Accessory Overhauler
- Aircraft Engine Tester
- Airport Service Manager
- Powerplant Mechanic
- Aircraft Welding Specialist

B. Post-Secondary Education
- Aircraft Technology for Powerplant Flight Engineer

Student Information

Cost: Uniforms approximately $21.50, tools - $150.00 requested, not required.
Available to Grades: 11 and 12
Length of Course: 2 years
Number of Credits: Four (4) per year
Location: Suffolk Aviation Academy MacArthur Airport

AVIATION SCIENCES MAGNET PROGRAM AT MIAMI HIALEAH SENIOR HIGH SCHOOL - DADE COUNTY (FLORIDA) PUBLIC SCHOOLS PROGRAM

(Information provided by Lucy Puello-Capone, Director, Division of Magnet School Programs, Miami, Florida.)

The Dade County, Florida school system has one of the largest number and most diverse magnet school programs in the nation. At Hialeah Senior High School the Aviation Sciences Magnet program is designed to explore careers in:

- commercial aviation
- military aviation
- air traffic control
- airport management
- meteorology
- computers

Students may enroll as early as the eighth grade and start in a post-eighth grade summer session that is designed to immerse the student in aviation as an introduction to the four years of study to follow. Similar summer sessions are available for students following the regular ninth, tenth and eleventh grade aviation studies. Following is the four-year curriculum sequence for students in this program.

MIAMI - DADE COUNTY

9th Grade

Concepts of Aeronautics
Algebra I or Geometry
Physical Science or Biology

10th Grade

Computer Applications for Aerospace
Aerospace Math/Science Applications
Algebra II or Geometry
Biology or Chemistry

11th Grade

Introduction to the Airline Business
Air Cargo Management OR Maintenance Licensure I, II OR Dual Enrollment (6 Hours)
Pre-Calculus
Chemistry

12th Grade

Maintenance Licensure III, IV OR Dual Enrollment (6-12 hours)
Calculus
Physics

Dade County provides transportation to magnet programs students and parents select. The student is assisted in getting to a magnet program and back home. Options include direct payment to the family to offset the cost of transportation or provision of Metrorail passes if the bus route does not allow for easy access to the magnet program.

The Dade County magnet school programs are all planned to prepare students to meet college admission requirements if that is the goal of the student.

An unusual feature of the Miami program is its articulation with the nearby Florida Memorial College which offers specialized undergraduate studies in the FAA Airway Science program.

In the curriculum sequence shown above it can be seen that there is an opportunity for the high school students to gain six hours of college credit in the eleventh grade and six to twelve hours in the twelfth grade if the student signs up for dual enrollment.

In 1988 Florida Memorial College was awarded a federal grant under the aegis of the United States Department of Education, Fund for the Improvement of Postsecondary Education (FIPSE) for start-up, operation and testing the concept of an Aviation Careers Accessibility Program (ACAP).

In this program high school students have opportunities for summer school residential sessions in the college setting to learn more in depth about various facets of aviation as well as careers. During the academic year high school students are given weekend activities at the college.

This program benefits the high school students as well as the college. Many of the high school students go on to study one of the Airway Science options at Florida Memorial College.

As in the case of the previously cited Suffolk County, New York program, articulation arrangements between high school aviation education programs and colleges represent mutual benefits for all concerned - especially the students.

WASHBURN HIGH SCHOOL AVIATION AND AEROSPACE MAGNET - MINNEAPOLIS, MINNESOTA

(Information provided by Jim Colby, Aerospace Magnet Coordinator.)

The Washburn High School Mission Statement indicates that it is:

> "... a caring student-centered, creative school committed to inclusive educational experiences which develop positive leaders, successful learners and active participants in a global community."

The Washburn magnet program objectives include the following:

- To provide a strong educational program focused on math, language arts, science, industrial technology, geography, communication and information technology and other appropriate classes.
- To offer a strong career education component that will broaden the students' awareness of career possibilities and the education and training necessary to make them completely qualified.
- To create a structured program in collaboration with institutions of higher education and aviation/aerospace businesses and facilities, which will provide students with on-site work experiences, internships and training.

WASHBURN

- To provide teacher training, counseling and other student support services which will:
    - strengthen the students' self-esteem, motivation and skills.
    - assist in program planning.
    - assist in transition from secondary education to higher education or jobs and to provide follow-up in the students' post-secondary endeavors.
- To market the Aviation and Aerospace Magnet with an emphasis on recruiting students from minority groups and females, who are under-represented in the industry.

Following are the nine courses available to Washburn Aviation and Aerospace students.

Aviation and Aerospace Fundamentals 1
(First third of full year course) (Grades 9, 10, 11, 12)

PREREQUISITES: Ninth grade students must have completed Aviation and Aerospace Science 9 and have recommendation of that instructor. No prerequisites for grades 10-12.

This course includes principles of atmospheric flight and the flight environment, aircraft systems and aircraft performance, aviation history and careers in aviation and aerospace. The class will include hands-on activities, flight simulation and flight opportunities.

Aviation and Aerospace Fundamentals 2
(Second third of full year course) (Grades 9, 10, 11, 12)

PREREQUISITES: Student must have completed Aviation and Aerospace Fundamentals 1 or have permission of instructor.

This course includes meteorology for pilots and interpreting weather data, basic aircraft navigation and radio navigation systems. The class will include hands-on activities, field trips, flight simulation and flight opportunities.

Aviation and Aerospace Fundamentals 3
(Last third of full year course) (Grades 9, 10, 11, 12)

PREREQUISITES: Student must have completed Aviation and Aerospace Fundamentals 1 and 2 or have permission of instructor.

This course includes aviation physiology, flight planning and decision making, the nature of space, rockets and space flight. The class will include hands-on activities, field trips, flight simulation and flight opportunities.

Principles of Aviation Technology 1
(One Trimester Course) (Grades 9, 10, 11, 12)

PREREQUISITES: Ninth grade students must have completed Aviation and Aerospace Science 9 and have recommendation of that instructor. No prerequisites for grades 10-12.

This is an applied science course with emphasis on technology learning activities relating to aviation. The activities include balsa airplane design and construction, propeller design, construction, test and analysis. Wind tunnel design and construction. Testing and analysis of airfoils in a wind tunnel. Work with and analysis of basic aircraft instruments.

Principles of Aerospace Technology 1
(One Trimester Course) (Grades 9, 10, 11, 12)

PREREQUISITES: Ninth grade students must have completed Aviation and Aerospace Science 9 and have recommendation of that instructor. No prerequisites for grades 10-12.

This is an applied science course with emphasis on technology learning activities relating to aerospace. The activities include rocket design, construction, flight and analysis. Work with robotic controls systems for aerospace. Design and construction of a space shuttle mock-up, lunar base design and construction or space station design and construction. Work with amateur radio and satellite TV communications.

Aviation and Aerospace Science 9
(One Trimester Course) (Grade 9)

This hands-on science class will include an introduction to aircraft and how they achieve controlled atmospheric flight. Rocket flight principles and space travel will be covered. The class will include aviation weather and aerospace applications of physics. Students will be introduced to information about a large variety of aviation and aerospace careers.

Geography From 30,000 Feet
(One Trimester Course) (Grades 10, 11, 12)

This class will be a multi-media exploration of the world from the traveler's perspective. Classroom activities will include outside speakers and field trips. Topics will include physical geography, art, food and air travel.

Orientation to the Aviation Industry
(One Trimester Course) (Grades 10, 11, 12)
(Two Class Periods Long at Airport)

This class will introduce students to the basic job requirements and duties for careers in General Aviation, the Airlines and the Federal Aviation Administration. Students will study airplanes, their types and uses, flight theory, airplane components and controls, airplane weight and balance, governmental regulatory agencies, airline trip planning and ticketing. Students will have the opportunity to observe a variety of aviation and airline occupations and obtain first hand information about job responsibilities, problems and satisfactions that an employee receives for an aviation carer.

Aviation Experience 1, 2, 3
(Three Trimesters) (Grades 9, 10, 11, 12)

This course is organized around a club theme. Students elect officers, set goals and work in groups to gain hands-on skill in building, flying and demonstrating model aircraft and rockets. The groups will visit nearby schools to show their models, share slides of club experiences and present relevant lessons to other students.

Based on the above courses, following is a typical schedule for Washburn students grades 9 through 12.

9th Grade

Physical Science 9 - Introduction to Aerospace (first trimester)
Physical Science 9 - Introduction to Physics
Physical Science 9 - Introduction to Chemistry
English 9*
Civics 9*
Health 9
Physical Education 9
Mathematics (Geometry, Algebra or Applied Mathematics 1)*
Principles of Aviation Technology or Principles of Aerospace Technology
Electives (Foreign Language, Fine Arts, Industrial Technology, Business, etc.)

*Full Year Courses

10th Grade

Aviation and Aerospace Fundamentals*
English 10*
World History*
Mathematics*
Biology*
Physical Education 10
Electives (Foreign Language, Fine Arts, Industrial Technology, Business, etc.)

11th Grade

Orientation to the Aviation Industry
Computers in Business
International Foods (home economics with an aviation flair)
English 11*
U.S. History*
Mathematics*
Physics*
Health 11
Electives (Foreign Language, Fine Arts, Industrial Technology, Business, etc.)

12th Grade

Principles of Aviation Technology or Principles of Aerospace Technology
Travel Geography
Aviation Internship or Aerospace Internship
English 12*
Mathematics*
Chemistry*
Economics
U.S. Government
Current Issues
Electives (Foreign Language, Fine Arts, Industrial Technology, Business, etc.)

*Full year classes

As of mid-1993, Washburn's Coordinator is working on developing a partnership between Washburn High School, Sauk Rapids High School, Minnesota Department of Transportation and Northwest Airlines. (The Sauk Rapids program is described below.)

SAUK RAPIDS, MINNESOTA HIGH SCHOOL SECONDARY AEROSPACE AND APPLIED TECHNOLOGY BUSINESS - EDUCATION PARTNERSHIP

(Information provided by Curt Olson, Technology Teacher) Note: Mr. Olson has received a number of awards for his creative efforts in designing this program and curriculum.

In the Spring of 1988 a partnership was formed between Sauk Rapids High School Technology Department and NASA Lewis Research Center. The goal of the partnership was to develop a general education aerospace technology curriculum for the secondary level with an emphasis on hands-on activities that stress problem-solving and applied math and science skills.

The curriculum is an aerospace technology model for the State of Minnesota Department of Education-Technology Education and the Minnesota Department of Transportation - Division of Aeronautics. Partnerships have been established with NASA Lewis Research Center and Northwest Airlines.

The curriculum is designed to be thirty-six weeks in length with emphasis on aviation during the first eighteen weeks. Units on space and the applied technologies needed for atmospheric and space transportation are covered during the second semester. (Many of the units and activities could be integrated into an existing General Technology Program.)

The first nine weeks of class are very structured to facilitate an overview of the technical and social aspects of aviation. The second nine weeks stresses aircraft design and construction. Some of the units and activities included in the first semester are:

1. The Role of NASA in Aerospace Technology
2. NASA Technology Spinoffs
3. History of Aviation
4. Principles of Flight
5. Aircraft Systems and Performance
6. Basic Navigation
7. Meteorology for Flight
8. Aircraft Design and Construction
9. Career Opportunities and Post Secondary Schools

Technology learning activities include:

1. Paper airplane design and construction.
2. Small balsa airplane design and construction.
3. Discovery Flight, Cessna 152.
4. Release of a 30-inch helium balloon to monitor atmospheric conditions.
5. Computer modem, weather analysis.

6. Propeller design, construction, test and assessment.
7. Construction of radio-controlled glider aircraft.
8. Spacelink-computer interface with NASA.

The major difference in this program occurs in the second semester of the program. Students are divided into teams to promote interpersonal skills and cooperative learning. Each team is assigned a problem that is presently being worked on at a NASA Research Center. The student team must research the problem, design a project that reflects their research and present their findings to the class. Some of the units include:

1. The Solar System and Beyond
2. Past, Present and Future of Spaceflight
3. Principles of Rocketry and Propulsion
4. Technologies Needed to Explore the Solar System
    A. Robotics
    B. Fluid Power Systems
    C. Radio Communications
    D. Radar Systems
    E. Thermo-Sensing
    F. Satellite Communications
    G. Space-Age Materials (Advanced Composites)
    H. Opto-Electronics
5. Living and Working in Space
6. Career Opportunities and Post-Secondary Schools

Technology learning activities include:

1. Wind tunnel design, construction and testing of various airfoils.
2. Lunar base design and construction.
3. Spacelink-computer interface with NASA.
4. Satellite dish set-up (satellite orbit mechanics).
5. Rocket design, construction, flight and analysis.
6. Robotic controls systems for aerospace.
7. Fluid power systems for aerospace.
8. Radar system analysis.
9. Micro-gravity simulation in the swimming pool.
10. Lunar Rover design, construction and test.
11. Amateur radio.

At Sauk Rapids High School this program is only offered to 11th and 12th grade students where it has been very well received. On an elective basis, approximately one third of the student body enroll in this class prior to graduation. The class meets daily, 48 minutes for 36 weeks. We are also enrolling students from other schools through Minnesota's Open Enrollment Program. (In Minnesota, students can enroll in the school of their choice free of charge.)

SAUK RAPIDS

MISSION STATEMENT FOR INDUSTRIAL TECHNOLOGY EDUCATION
For Independent School District 47, Sauk Rapids, MN

The study of industry and technology should result in people who participate in and adapt to a dynamic technological society. This study provides application and immediate relevance to principles of math, science and other subject areas while focusing on the development and application of industrial technologies. Thus, students of industrial technology education become self-learners and problem solvers, as well as self-reliant and productive members of society.

Goal Statements

Consistent with the student's abilities, interests and needs, Aerospace and Applied Technology education must:

1. Prepare students to work with technical systems within the area of aerospace transportation.

2. Assist students in assessing and preparing for current and emerging aerospace occupations.

3. Enhance student mastery of the basics through application of math, social studies, communication and computer literacy.

4. Develop student awareness and skill through the safe utilization of tools, materials and equipment for leisure time or career-oriented activity.

5. Provide students with a foundation in entrepreneurship, economics and business relationships of the aerospace industry.

6. Assist students in becoming independent learners and creative problem solvers who possess self-confidence and lifelong learning attitudes.

7. Establish beliefs and values based upon the impact of industry and technology and how it alters environments.

8. Explore and develop human potential related to responsible roles in a technological society.

Skills, Knowledge and Behavior To Be Developed

The student will be able to:

1. Identify and evaluate the components of aerospace transportation systems.

2. Identify skills necessary for careers in aerospace transportation.

3. Understand the technical advances in aerospace transportation systems.

4. Design and construct a model of an aerospace vehicle.

5. Use and analyze aerospace subsystems.

6. Understand laws, regulations and safety procedures related to aerospace transportation.

7. Understand the impacts of an aerospace transportation system on society.

8. Understand human and machine monitor/control devices used in the aerospace industry.

9. Select and use appropriate tools, techniques and devices related to the aerospace transportation industry.

Learner Outcomes For Aerospace Technology

The learner will:

1. Briefly summarize the history of aviation/aerospace.
2. Identify the sociological impact of the aviation industry.
3. Briefly explain the impact of the aerospace industry: manufacturing, air transport and general aviation.
4. Identify career opportunities in the aviation industry.
5. Explain aviation fundamentals, flight principles and aerodynamics.
6. Identify aircraft systems and instruments: fuel systems, ignition systems, lubrication systems, cooling systems, electrical systems and instrumentation.
7. Discuss aircraft weight, balance and performance.
8. Describe FAA rules and safety regulations that apply.
9. Explain the physiology of flight.
10. Construct and fly a basic glider, a rubber band powered airplane, gas-powered airplane and a radio-controlled airplane.
11. Explain the functions and roles of the Civil Air Patrol and the Federal Aviation Administration.
12. Demonstrate an ability to plan a flight and fly an airplane using a computer simulation.
13. Identify local resources available to those who want to obtain a private pilot's license.
14. Understand the practical application of weather analysis and forecasting as it applies to aircraft operation.

SAUK RAPIDS

15. Use the flight computer to perform computations associated with aerial navigation.
16. Demonstrate principles and techniques associated with aeronautical chart interpretation.
17. Explain the practical application of radio navigation and communication.
18. Describe fundamental theories, principles and techniques in relation to valid value judgments associated with various flight situations.
19. Summarize the fundamental theories and scientific principles pertaining to the geographical, physical and chemical nature of space.
20. Summarize the history of space exploration.
21. Summarize the history of rockets and space flight.
22. Describe the present and future status of space flight.
23. Explain the theories and principles of rocket propulsion.
24. Discuss space physiology.
25. Explain the theory of satellite deployment, communication and its relationship to our space programs.
26. Will describe the theory of a radar system.
27. Describe our solar system and the future exploration of it as it applies to the NASA Aerospace Program.
28. View through a telescopic device various astronomical regions.
29. Develop futuristic thinking skills.
30. Demonstrate decision making skills.
31. Demonstrate and further develop applied math skills.
32. Demonstrate team work and interpersonal skills.
33. Demonstrate and further develop applied science skills.
34. Demonstrate the ability to follow directions.
35. Demonstrate and identify quality workmanship.
36. Exhibit creativity skills.
37. Demonstrate and further develop communication skills.
38. Demonstrate inventiveness.
39. Meet deadlines while performing all activities.
40. Keep statistical data on a computer spread sheet and summarize statistical data.
41. Use Spacelink to interface our computer with one of NASA's Research Centers and use SpaceNetwork to interface with the U.S. Space Foundation.

Mr. Olson has indicated that many of his advanced students come to class, on a voluntary basis, an hour early and start study, experimentation and project development at 7:30 in the morning.

Space does not permit publishing the entire materials, activities and projects Mr. Olson has developed relating to both aviation and space. Anyone planning an approach similar to this would do well to study the entire Sauk Rapids Aerospace Program.

DELCASTLE TECHNICAL HIGH SCHOOL - AVIATION MECHANIC PROGRAM - WILMINGTON, DELAWARE

(Information provided by Albert E. Leonard, A & P Instructor)

Delcastle Technical High School is one of three secondary schools in the New Castle County Vocational Technical School District.

The District works to enable students to reach their potential as productive and successful members of the adult community. The vocational technical schools offer students well researched and innovative curriculums that combine academic instruction, career training and work experiences which bridge the transition of learning from the classroom to the workplace.

The success of the aviation program at Delcastle has resulted largely from the initiatives of a masterful and resourceful teacher - Albert E. Leonard. His long experience as a helicopter mechanic and technical historian of helicopters gives his high school aviation maintenance students additional background that would otherwise not be available to them. One can gain insights into the nature and extent of some of the aviation offerings at Delcastle by noting the following Four Year Plan of Study for the Program for Aviation Mechanics.

1. Program Name: Aviation Mechanics
   Credits: 9 (Includes Related Courses)
   Location: Delcastle
   Length of Training: 3 years

2. Program Objective:

Aviation Mechanics inspect repair, service and overhaul all airplane parts. It is their responsibility to maintain the aircraft in top operating condition. Many mechanics specialize in scheduled maintenance, following a timetable based upon the number of hours flown as well as the calendar days. Inspections are completed according to strict Federal Aviation Administration (FAA) requirements and necessary maintenance is performed. Other mechanics may select specialization in repair work, identifying a problem and making the proper repairs.

Employment is primarily found with airlines and government; however, independent repair shops and companies that operate their own aircraft also hire mechanics. Assembly work is another option for a mechanic. Above-average income and a job market that is expected to increase through the 1990's are additional incentives to enter this rewarding and highly responsible career area.

This course is based on the Federal Aviation Administration (FAA) requirements for the aviation mechanic license. The program prepares the student to obtain a power plant rating. To be federally licensed, a student must pass the FAA written and practical examination for the power plant mechanic.

3. Employment Opportunities:

Average Earnings:
Starting $8-10/hour up to $23/hour and beyond.

Areas of Employment:

621.281.010	Air Conditioning Check Out Mechanic
621.281-014	Air Frame and Power Plant Mechanic
621.281-026	Mechanic, Field and Service
621.381-010	Flight Test Shop Mechanic
621.381-014	Mechanic, Aircraft Accessories
621.684-014	Reclamation Worker
806.281-038	Mechanic, Aircraft Rigging and Controls
806.684-110	Pressure Sealer and Tester
807.261-010	Aircraft Body Repairer
807.381-014	Bonded Structures Repairer

4. Entrance Requirements Prerequisite

(A) To do this kind of work, you should have these interests and aptitudes:

- understand and use blueprints, sketches, drawings and other kinds of specifications.
- detect differences in the shape, size and texture of various items.
- pay strict attention to standards, guidelines and ALL Safety Standards.
- make decisions based on personal judgments and facts.
- coordinate eyes, fingers and hands to operate equipment, adjust instruments, make sketches, or use measuring tools.
- perform detail work with great accuracy.
- use clear language to write technical reports.
- visualize how a finished product will look or how a system operates.
- use arithmetic to measure, compute the amount of material to use and inspect the product to be sure it conforms to requirements.
- read and follow instructions to set up and adjust machines and equipment.

(B) Math Skills:

Compute discount, interest, profit and loss; commission, markups and selling price; ratio and proportion and percentages. Calculate surface area, volume, weights and measures.

Algebra: Calculate variables and formulas, monomials and polynomials; ratio and proportion variables; radicals.

Geometry: Calculate circumference, area and volume for plane and solid figures. Understand the kinds and properties of angles and intersections.

(C) Language/English Skills:

Reading: Read a variety of trade-related manuals, instructions, magazines and encyclopedias. Read safety rules, instructions in the use and maintenance of shop tools and equipment and methods and procedures in mechanical drawing and layout work.

Writing: Write reports and essays with proper format, punctuation, spelling and grammar.

Speaking: Speak before an audience or as part of a panel with poise, confidence and a well-modulated voice. Speak at all times clearly and distinctly with appropriate pauses and emphasis, correct pronunciation, variation in word order and the use of correct tenses.

(D) Science Skills:

Demonstrate technical competencies and logical thinking skills in the interpretation of processes and principles. Utilize measurements in the operation of specific technical equipment plus possess the ability to observe, classify, measure, infer and manipulate variables and interpret charts, graphs and tables.

(E) Physical Skills & Description of Abilities:

Be able to initiate conversation with other workers. Exhibit good vision, speech and fine motor skills. Additionally, the students should be able to stand for long periods of time, be able to lift approximately 50 pounds and bend at the waist and knees without difficulty.

(F) Other Considerations:

- Follow Directions
- Exhibit Good Behavior
- Work Well With Others
- Be a Good Listener
- Demonstrate Comprehension Skills
- Be Drug Free
- Be Honest
- Be Dependable
- Have Good Attendance

The unit outline of the Aviation Powerplant Maintenance Technology program shows the variety and depth of this hands-on educational program.

SHOP ORIENTATION:

I. Shop Safety/Right to Know
II. Shop Organization/Operation
III. Handtools
IV. History of the Aviation Profession
V. Business in Partnership Education/Professional Organizations

GENERAL CURRICULUM:

I. Aviation Mathematics
II. Aircraft Drawings
III. Basic Physics
IV. Basic Electricity
V. Materials & Processes
VI. Fluid Lines & Fittings
VII. Cleaning & Corrosion Control
VIII. Ground Operation & Servicing
IX. Maintenance Publications
X. Mechanic Privileges & Limitations
XI. Maintenance Forms & Records
XII. Weight & Balance

POWERPLANT CURRICULUM:
PART ONE: POWERPLANT THEORY & MAINTENANCE

I. Reciprocating Engines
II. Turbine Engines
III. Engine Inspections

POWERPLANT CURRICULUM:
PART TWO: POWERPLANT SYSTEMS & COMPONENTS:

IV. Lubrication Systems
V. Engine Fuel Systems
VI. Fuel Metering Systems
VII. Induction Systems
VIII. Engine Cooling Systems

IX. Engine Exhaust Systems
X. Ignition Systems
XI. Engine Electrical Systems
XII. Engine Instrument Systems
XIII. Engine Fire Protection Systems
XIV. Propellers

An overview of what is done in a four year period shows the combination of theory, practice and co-op work experience which combine to produce graduates ready to start in entry level positions in the aviation industry.

CURRICULUM OVERVIEW

AVIATION MECHANICS

FRESHMEN CLASS CURRICULUM

The freshmen class exploratory students are in the aviation program for twenty-two days at two periods daily. They are given a presentation and tour of the aviation shop to instill interest in the aviation industry. They watch numerous VCR tapes on the trade and some on the mechanical side of what's expected of the aircraft mechanics. The students are given hands-on safety wiring experience that is used on aircraft. The remainder of their time is spent in the shop working with the other classes.

SOPHOMORE CLASS CURRICULUM

The sophomore class students are in the program for three periods daily. They spend approximately sixty percent of their time in theory classroom and forty percent in the shop doing hands-on work. They start off their year with safety and shop orientation. Next, they are instructed in the use of hand tools and shop equipment. During this time they do several shop projects to illustrate their understanding of tool use. The primary objective at this point is to create a basic mechanic. The remainder of the year is spent in the FAA Airframe and Power Plant general subjects as spelled out in the course outline.

JUNIOR CLASS CURRICULUM

The Junior class students are in the shop for three periods daily. They spend approximately fifty percent in theory classroom and fifty percent in the shop mastering skills that have been demonstrated in the classroom. They complete the balance of the FAA Airframe and Power Plant general curriculum, then begin to work into the FAA Power Plant curriculum. They are given time to develop skills and practices that are required to compete in the aviation industry.

SENIOR CLASS CURRICULUM

The Senior class students are in the shop for four periods daily for a two week rotation. The alternate two weeks is spent co-oping in the aviation industry. If a job is not available or if the student wants the extra shop experience, then the student spends the two weeks in the shop for seven periods daily gaining experience working on live projects. The two weeks of program time is spent with approximately forty percent theory classroom and sixty percent in the shop demonstrating responsibility to the underclassmen while they work on live projects they will encounter in the aviation industry.

Since the Delcastle technical aviation program was started in 1975 there have been two hundred and twenty-five (225) graduates. One hundred and fourteen (114) of them have gone into the military or on to higher technical or management education as well as to industry. Many of the others may be found in excellent positions throughout industry in very responsible positions.

A recent article in the magazine Choice published by the Newcastle County Vocational Technical School District includes an interview with a student in the Aviation Mechanic program. This article should give educators, guidance counselors, parents, employers and others insights into why we need to change attitudes about preparing young women for careers via nontraditional education programs.

**Janette Bizub, 11th Grade, Aviation Mechanics,
Delcastle Technical High School**

Janette Bizub has always loved airplanes. When she was little, her mother and grandfather used to take her to the airport to watch the planes land and take off.

"I always knew I wanted to do something with airplanes, so I guess entering the Aviation Mechanics program at Delcastle came as no surprise to my family," she says. "My mom thought it was great. Whatever I wanted to study, she backed me up, which really helped. I also have gotten a lot of support from my teacher, Al Leonard."

Friends have been less supportive, she confesses. "I think I lost some girl friends when I chose this program," she says. "I know some of them just couldn't understand why I would want to be in the aviation class and not pick something that was more 'normal' for a female. I just decided not to let that bother me. I knew what I wanted to study, and I really enjoy it."

Being the only female in her class, she says she had trouble gaining acceptance from her classmates at first. "Once the guys saw that I could do the work, they accepted me. Now I fit right in." She also realizes she may have a harder time getting a job in her field, but she is confident that, "when I get the chance to show them I know what I'm doing, they will see there is no difference between a man and a woman doing this job."

Janette admits that her class is difficult. "Sure, I get frustrated sometimes. It is very hard work, and you really have to think. But after I struggle with something, I really feel good about myself. I see all the hard work I've done and see all I have accomplished, and I know it's all been worth it."

Janette has high hopes. She plans to become a certified aviation mechanic following graduation, and she also wants to learn to fly.

She has strong feelings about students choosing career programs. "Pick careers you are interested in, and don't worry about what people think. Wouldn't it be sad if you gave up something you thought you might really love because you worried about what others would think? You'll never know unless you try it."

SKYLINE CAREER DEVELOPMENT CENTER - AERONAUTICS CLUSTER - DALLAS, TEXAS

(Information provided by Jerry Smith, Skyline Center Aeronautics Cluster Coordinator.)

SKYLINE CAREER DEVELOPMENT CENTER

AERONAUTICS CLUSTER

The planning for Skyline Center began in the mid-60's under the leadership of the General Superintendent and Board of Education of the Dallas Independent School District (ISD) with help from numerous groups and individuals in the Dallas school community. The Texas Education Agency, the Dallas Chamber of Commerce and representatives of many industries lent emphasis to the project.

Successive General Superintendents and Boards of Education have always designated career education as one of the priority goals of the District.

Skyline Center is located on an 80-acre campus easily accessible by R.L. Thornton Freeway (Interstate 30) and Loop 12 (Buckner Boulevard). The building complex covers approximately 14 acres under roof and is environmentally controlled for year-round comfort. Some of its unique aspects include a complete color television studio with a network of 250 viewing stations, a large computer center, a 30,000 square foot aircraft hangar surrounded by classroom space, extensive media center, a 1,600 square foot greenhouse and numerous other special-purpose areas. This multipurpose facility provides extensive educational opportunities to the Dallas metropolitan area. Its educational components include a comprehensive high school, a career development center with approximately twenty-five career choices and an adult education department.

The Career Development Center (CDC) evolved as a direct result of the needs of area businesses in terms of their requirements for trained manpower and the needs of today's youth who desire a more meaningful and practical education to meet the job world facing them after successful graduation.

In deciding to incorporate a curriculum dealing with some phase of aviation education, the School District was responding to the needs of the community on the national, state and local levels. The aviation industry has enjoyed a period of steady growth over the past several years with continued development predicted. The job opportunities created by this expansion in turn creates a need for more people trained to work on, or provide services to, the aircraft being flown.

With the assistance of the industry-supported Aeronautics Career Cluster Advisory Committee, the School District decided to inaugurate an FAA-licensed Airframe and Powerplant Mechanics program as the curriculum of the Aeronautics Career Cluster. The Skyline-licensed aircraft mechanics program is the only one of its kind offered in a Texas public high school and only one of a very few offered in a public high school in the entire nation.

The Aeronautics Cluster curriculum provides training to interested high school sophomores, juniors and seniors in the subjects and skills needed to eventually qualify them to take the FAA's Airframe and Powerplant Mechanics exam. Skyline's aircraft mechanics program was certified in 1972 for full operation. It carries an enrollment of approximately 200 students every year, with an average of 20-30 students completing each year to articulate on to advanced training. The students are trained in a well-equipped aircraft hangar housing several complete aircraft and helicopters, along with numerous reciprocating and turbine engines. Shop areas and labs are furnished with up-to-date equipment, materials and supplies.

Students for the Aeronautics Cluster are recruited from Dallas I.S.D. middle school eighth grade classes into a one hour ninth grade Aero Education orientation class. Generally, a simple application is submitted for admission into the program.

After completing the ninth grade Aero Education class, the student can elect to enter the Aviation Maintenance Training program in his tenth grade year during either the morning or afternoon - a three hour class. This accounts for 525 hours of training for one year and includes all of the subjects in the FAA's part 147 general curriculum outline such as: basic electricity, materials and processes, weight and balance, cleaning and corrosion control - to name just a few.

If the student desires to continue during his junior and senior year he will be able to pursue approximately 50% of the airframe and powerplant subjects such as: sheet metal, hydraulics, welding, landing gear, reciprocating engine overhaul, turbine engine overhaul, ignition systems and fuel metering systems to name a few subjects covered in these two areas.

At the present time Skyline Aeronautics Cluster is able to provide approximately 75% of the required training necessary to meet the FAA's criteria for taking the aircraft mechanic's exam. A student graduating from Skyline Center's Aeronautics Cluster can articulate into aircraft maintenance programs at Tarrant County Community College, Texas Aero Tech, or other close-at-hand locations. A complete up-to-date transcript is provided, upon request, for each student entering another institution to complete his aircraft mechanics training.

The industry advisory committee served the Aeronautics Cluster well during the initial formative years and then for various reasons fell inactive for a number of years. Wisely, the Aeronautics Cluster began reorganizing its Advisory Committee during the 1987-88 school year. This reorganization effort was initiated by Kathleen Lynch who, at the time, was serving as the Education Representative for the Greater Dallas Chamber of Commerce. Through her efforts in contacting representatives of the aerospace industry we received approximately thirty volunteers. These individuals are dedicated and committed to improving the entire educational scope of the Aeronautics Cluster and where it fits into the total metropolitan educational process of our young people.

In order to utilize that much manpower, the Advisory Committee elected a Chairman who established five subcommittees and solicited members to head up each subcommittee. After reviewing the areas of responsibility, each subcommittee established goals for the present school year as well as for future school years.

The Aeronautics Cluster has benefitted from the committees' efforts in ways such as: curriculum review, student recognition, organized field trips, donated items, receipt of materials and supplies and several full-paid scholarships for students to attend Tarrant County Junior College in order to complete their aviation maintenance training program.

It appears that this committee will certainly serve the Aeronautics Cluster and its educational goals well for years to come.

The Aviation Maintenance Technician Curriculum includes the following three areas:

General Subjects

Mathematics
Physics
Weight & Balance
Materials & Processes
Ground Operations
Basic Electricity
Aircraft Drawings
Fluid Lines/Fittings
Cleaning & Corrosion

Airframe Subjects

Wood/Fabric/Finishes
Sheet Metal
Landing Gear Systems
Fuel Systems
Airframe Instruments
Assembly & Rigging
Welding
Hydraulics/Pneumatics
Position/Warning
Airframe Electrical
Cabin Atmosphere
Airframe Inspection

Powerplant Subjects

Reciprocating Engines
Engine Ignition
Engine Instruments
Induction/Exhaust
Lubrication
Turbine Engines
Powerplant Electrical
Fuel Metering
Propellers
Powerplant Inspection

SECTION VIII - ONE PERSON CAN MAKE A DIFFERENCE

Aviation magnet projects, activities, programs and schools, over the years, have usually resulted from the initiative of one person. Many projects are established and conducted largely through the vision, persistence and dedication of that one person. Frequently programs grow and are enlarged by getting others to see the benefits of the activity, project or program and join a network of people who see the need to conduct and expand learning via aviation programs.

Following are selected examples of magnet activities, projects, courses and programs that have relevance for anyone or any school or community sponsor. The material that follows includes first-person accounts of program design, planning and operation.

WEBER COUNTY HIGH SCHOOL AVIATION EDUCATION PROGRAM - OGDEN, UTAH

JOHN V. (JACK) SORENSON

THE WINGED WARRIORS

OVERVIEW:

The Winged Warriors name was an enhancement of the high school symbol: The Weber Warriors. It helped to identify the group within the school. Weber was a county high school, with an 1,800 student enrollment, a superior principal (Roy Metcalf), an outstanding faculty and an excellent reputation as an academic and athletic institution within the state of Utah. I went there to coach. I was told by Metcalf that coaches had to teach a full load, as well.

At the time I started (1949) there was a course called "Aeronautics." The course was taught by an aging science teacher. He had taken the assignment as a "patriotic duty" during World War II. The hope was that this course would encourage young men to become interested in aviation and then enter the military as an air or ground crew member. The course was dying a slow but predictable death. Besides, World War II had been over for four years. The course had run its course.

I was asked by Mr. Metcalf what I could teach. In my best fighter pilot, quarterback and entertainer confidence I told him, "I could teach anything." That's what he gave me! I accepted Aeronautics as one of five different solid subjects that I was to teach. Each one of the other fields had tenured teachers lined up three deep.

If I were to stay at Weber I had to create a niche for myself and I selected Aeronautics. [An amazing grasp of the obvious.]

I told Mr. Metcalf that I totally disagreed with the orientation of Pope and Otis, authors of the course textbook. The book was too science oriented, too difficult and lacked the romance, lore, meaning, concepts and passion of flight as I had come to know it as a pilot in World Ear II. Metcalf didn't even flinch. He asked why? I told him. He said, "Do it your way with excellence." Until Civil Air Patrol came along with Volume I, Book Two, I was without a text and relied almost exclusively on what I had learned while becoming and serving as a pilot in the U.S. Army Air Corps.

The first year classroom dilemma had two major and a myriad of minor facets. The two major facets were (1) trying to keep ahead of students in Physics, Biology, Physiology and Mathematics; and (2) handling and making exciting the study of aviation without a textbook of comparative values and information. A disturbing minor facet in Aeronautics as conducted BS (before Sorenson), was that the teacher was doing all of the study and the students were listening to science lectures conveyed to them in monotone by a talking head.

So, the first year I was doing more study (in at least four separate subjects) than the students and in Aeronautics, soon to be known as Aviation Education, I was trying to find the right approach (sans textbook) in making the course interesting and demanding for those that enrolled. I swore that my objective was to make the Aviation Education (AE) program so interesting and exciting that the enrollment would swell to five classes per day. Then I could be relatively comfortable daily with AE and coaching football, basketball and track. The third year there were five classes per day, 40 students per class. The days were full and joyful.

AN APPROACH TO THE TEACHING-LEARNING PROCESS

Anyone with walking around sense that has done any coaching knows that the wise coach makes his drills and practices as close to game situation as possible. What I found about the previous teacher, course and text was that the whole posture was light years away from reality.

Let's begin with making the study of each major study area within AE a real-time living and interesting program. One that is extremely demanding of the student, yet fun and on target as to learning. Moreover, to make this meaningful within the school, each aspect of the whole AE experience had to be related to as many other courses and activities as were possible within the school/community milieu. There had to be a fundamental understanding on behalf of the students that they were to do the study, research, documentation, learning, sharing and changing. In addition, they each had to accept and perform the continuing responsibility to sell "Air Power" within the school, community and nation. Finally, the AE classroom was the crucible in which they would, individually and collectively, prepare to do that.

This placed each student in the triple role of student, scholar and missionary for air power. This was the light year plus beyond Pope and Otis and the previous Aeronautics class. This wasn't simply change, it was revolution. The kids, after they found out that I meant it, loved it. It seemed to them that it was the only time and place at Weber where they were actually responsible in a fun, demanding course with a mission. Propaganda? So be it!

NOTE: I hadn't been prepared by a college of education to do this. Therefore, I felt I was treading on new turf. The longer view suggests that this may have been the only approach in which we could reach what I had hoped we all would accomplish together.

MAKING EACH SUBJECT AREA LIVE, EXCITING, DEMANDING AND REAL-TIME

This is really a difficult task. How do you get this done with such things as air flow, clouds/rain, airports and Federal Aviation Regulations (FARs) to name but a few?

One of the first steps was inventorying the resources inside and outside the school. There was, from all walks of life, a multitude of air and ground crew members in the community who had shared the World War II experience. All wanted to help tell the air power story. So this became a tremendous resource. There was an airport, a weather service station, a fixed base operator, air controllers, Hill Air Force Base, city, county and state agencies and pilots galore. How do you harness such a bounty? I decided to organize it and then assign the process to the kids. It worked!

The inside school inventory consisted of the entire school, most importantly, the kids themselves. Each department, where possible, would be invited to share in this initiative. I thought that would be the most difficult task of all. It wasn't because the kids carried to their other classes real projects for development within that curricular area.

As a major incentive to the students (during the first class period in the 1950 school year) I announced that if they completed the tasks assigned with excellence and enthusiasm they would be assured of at least one flight in a real airplane. Their excitement was high and continued through the entire school year. This fact alone assured me of the tremendous motivation aviation and flight held for those and all kids. That motivation is natural, exists today and the wise teacher will use it regardless of subject area or grade level in their arsenal of instructional weapons.

SOME ACTIVITIES THAT WORKED VERY WELL

FLIGHT

Flight was difficult to begin with. Finally, I resorted to paper airplanes, balsa models, powered models (Demonstrations) and plastic models of all shapes and forms. We involved the industrial arts teacher on woodworking, Hill Field aerodynamicists, personal airplane builders, airplane contests, et al.

Paper Airplanes (American Origami). Everyone in the class knew how to fold one. However, their assignment was to fold three. Three categories of performance:

1. Directional Stability
2. Endurance
3. Acrobatics

The class didn't know how to go about it. So I established some parameters within which they must perform.

> Directionally: they must hand-launch their plane from a distance of 25 feet and pass through a gate (in flight) 4 feet wide.
>
> Endurance: time of flight had to be a minimum of 15 seconds involving a continuous turn left or right (predicted in advance).
>
> Acrobatics: required one loop, a gentle turn right or left (predicted before flight) and land softly.

There was pandemonium. I left the room. Returning 20 minutes later I found that the leadership had emerged and they were talking loudly to the one they had designated leader about how they would go about this. Was that ever fun.

At this point the planned curriculum "flew west." They started building (folding) all the airplanes out of the same weight of paper. This changed with the understanding of performances required. Knowing little about the effect of a poorly "built" aircraft in flight caused them pain. Ultimately, they studied controls, airfoils, air currents, launching techniques, etc. Ultimately, they all passed the aircraft performance standards. Then we went outside to the football bleachers for the same tests. No one could pass the tests outside they had succeeded in doing inside. Now they had to deal with weather, wind currents, vertical air movement, et al. If I was sure of one thing it was that learning was taking place. However, it did not resemble in any way, shape or form the "desired" and controlled study outline of the traditional administrator's vision.

Balsa models were a jump shift for them. The effect of controls on aircraft in flight was now well established by the group. The woodworking techniques gained from the Industrial Arts teacher helped. When the aircraft failed to perform just right, the kids cut and pasted surfaces on the aircraft around the three axes of flight to cause them to do so. The performance standards concept was in place here, as well. However, the demands were much more exacting. This time they enjoyed the challenge because they understood. Psychic pay!

An enjoyable note here: The kids consulted the chemistry teacher to find out how to determine the weight and adhesive strength of the glue available to construct balsa models. In the process, the first model was a commercial job. Thereafter, they designed their own!

This led to a crudely made wind tunnel with an assignment to study airfoils and the forces of flight. We also tried to duplicate some of the Wright Brothers rudimentary airfoils and replicate the studies the brothers conducted. All of a sudden the classroom had to remain open in the late afternoon: "There was so much to do."

Almost immediately I began to get concerned looks from the English teachers. Suddenly essays and papers were devoted to the topics of flight, airfoils, the effect of the sun on heating the earth, and subsequent vertical currents. What was going on? What was most important was that the kids were doing better in other courses utilizing their new found knowledge and confidence. The entire school was changing. Now to the community.

Powered Aircraft Models. These were less important and interesting to the kids than I thought they would be. We spent little time here. We went straight to the airport. They wanted to see the real thing. They had already set their sights on the end of assignments promise: flight!

Some few, mechanically oriented boys mostly, did continue in the field of powered and subsequently radio-controlled models.

NAVIGATION

This was difficult to figure as an activity. We selected Russell Maughan's (a native Utah aviation hero) Dawn to Dusk flight across the U.S. to become our first focus. A glossary of terms on navigation was provided and the students were asked to determine the time rate and distance factors, and true headings of each leg of the flight.

They already knew that wind existed (paper airplane activities). This alone had caused them to fail the first time outdoor flights of their paper airplanes. They went to work and delivered the information. We then checked our results against the personal log of Russell Maughan. We did the same thing with several other overland and water flights (real, historic or created). They learned what the elements of navigation were.

To finish this completely, they obviously had to do research in the library, consult with their geometry and physics teachers on angles, time, rate, distance, vector forces, adiabatic lapse rate, etc. Many that weren't already enrolled in physics because it was too difficult, did so. Those that were the "physics types" performed aeronautical experiments in their laboratory periods. These had been virtually nonexistent as physics lab topics before.

To close this out, I specified a route for their end-of-school flight which they had to plan and check as navigators for the flight. This required hand held flight computers, math, ratios, knots vs. miles per hour, time-rate-distance understandings of everyone. We were all over the school. This led to serious studies on the effect of flight on the body, air space (some controlled areas existed in the flight path), etc.

Everything that was done was set up by their role as the student. Short statements on my behalf rather than endless lectures began each class. I was always available to answer questions as to sources or clue them gently in a specific direction.

We took one wall, next to the Link Trainer, and placed planning charts on it as wallpaper. The maps were obtained from Hill Air Force Base and they formed a giant U.S. planning chart. A compass was placed on the wall at Ogden, Utah and we became the navigation capital of the nation.

FEDERAL AIR REGULATIONS

This may sound bizarre, yet we began our study of the monotony and boredom of FARs via an airport project. Virtually all flights begin and hopefully end at an airport. So in order to make this a vital study I assigned them to design an airport of their very own. Instructions read like:

1. Choose the type of airport you wish to design: one from your own farm, a small public airport, a county airport such as the one in Ogden, a major or international airport.
2. Locate the ground upon which you would build your airport. It had to be within the county.
3. Go to the public records, find out who owns (multiple owners in most cases) the property.
4. Visit each owner and describe your project.
5. Ask them what they would sell their property for.
6. Obtain approval to walk their property.
7. Walk the property.
8. While there, set up wind indicators that can be observed from access roads.
9. Check those wind indicators twice daily for two weeks.
10. From your record of two weeks, determine the prevailing wind pattern(s).
11. Set your runway pattern based upon FAA regulations and relative winds.
12. Design your airport around that wind pattern.
13. Prepare a detailed drawing which includes the legal address, your design, the owners by name and street address and all other details available.
14. Schedule an appointment with the County Civil Engineer (World War II pilot, 50 missions).
15. Discuss what must be done to the property to ready it for construction.

16. Consult with the Business Education Teacher and an attorney on specific proposal.

17. Name your airport.

18. Make an appointment with FAA representative to discuss your airport reviewing what FARs apply.

19. Develop an understanding of all FARs that apply.

20. Stand in front of your classmates and describe and display your airport plan.

Classmates were assigned the responsibility of grading the effectiveness of the plan, its presentation and overall quality of scholarship, enthusiasm, etc. they had to choose the best in each airport category and an overall winner.

The work was effective to the degree that these kids knew more about airports, appreciated the value of such a facility and had found out many more things about the community, land owners, politicians, FAA, Fixed Base Operators, and many other aspects of life and living in an air world. As one can readily see, this project could consume a great deal more.

WEATHER

This started almost mid-year the first year and was first thereafter. The tasks were significant. The students would: forecast the weather from the tele-type machine the weather service had installed in the classroom (the weather people were from World War II). A national planning chart was placed in a 5' x 8' light box. Holes were drilled at major weather reporting stations and the shop man helped us understand plastics and three color lucite plugs (red - bad weather; amber - marginal weather; and green - good weather) were appropriately placed in the light box. Then on the lucite cover on top of the chart with the holes drilled through it, the air mass lines were drawn (blue - cold front; red - warm front, etc.). Then each day, three times per day, weather forecasts were delivered over the PA system and stand up weather briefings were given as assignments in the main hallway during lunch period. Students outside AE were asked to grade the effectiveness of the weather presentation.

We forecast proper wear and weather for all outdoor school events, weekend weather, etc. Moreover, we learned about weather, could forecast it better than the weather service and beat them with better forecasts regularly. One of the most effective drills was going to the football bleachers and charting cloud movements, changing shapes, putting time/date stamps on each and then returning to analyze the atmospheric conditions.

THEORY OF FLIGHT

Our own cardboard, electric fan, egg carton grid, wind tunnel did most of this. This was discussed earlier in modeling. The experiments to duplicate Wright Brothers airfoils and replicate their data was very difficult. We did get to know the elements of the Clark Y and Laminar flow wings in part. Our device, it was deduced, was too crude.

AIRCRAFT STRUCTURE, MODELING, IDENTIFICATION

When you get into talking about airplanes it's a little bit like a coach talking in x's and o's. So we put together the plastic models, built the balsa models and hung the best and most representative of all of these from the ceiling. We would have a series of dialogue sessions discussing shapes of wing, fuselage, engines, etc., from the three viewing angles. These also included aspects such as propeller, jet, rocket driven, range, function, design, historic role each had a part in. Along with this was a study of pioneer events, the impact of air power on the world - both civil and military. All of these thoughts flow from the motivation of aviation and its impact upon the revolution this caused at Weber High.

DID THE CURRICULAR EXPERIMENT WORK?

This will be mostly conjecture. I believe that it did. I have not mentioned the Civil Air Patrol Cadet Squadron that was a central part of the program, nor did I mention all of the activities associated with the CAP and school activities.

We did extensive flying in years 2 through 6. CAP's L-4 and L-5 aircraft were used hundreds of hours. In year 3 we purchased a Schiewtzer TG-2 glider and proceeded to launch hundreds of times using a Salt Flats location and a truck for towing. The Link Trainer (CAP-USAF connection) we used for flight orientation including extended "under-the-hood" flights for those so inclined. USAF airlift was used to orient to military air power and excite the students.

I do know that seven young men went to and graduated from West Point. Each one of them joined the United States Air Force. All became USAF pilots. Two achieved General status, one got his third star. There were 12 doctorates out of the 6 years and I wouldn't be able to predict how many went on to advanced degrees. What is/was more important to me is/was the fact that 6 years of students (240 was the greatest number, in year 6) all studied Air Power and all of its facets and were able to think and live in an aerospace world. I'm certain that if you look at it through that "eye piece," it was a howling success. If ever there was a measure of success that has to be solid gold.

WRIGHT FLIGHT - HELPING KIDS REACH NEW HEIGHTS

MAJOR ROBIN STODDARD (ANG) F-16 PILOT

While a Captain in the U.S. Air Force, fighter pilot Robin Stoddard saw the potential to help students improve their grades, self-esteem and behavior by encouraging them to set goals of self-improvement by studying aviation. The incentive for goal setting and achievement was the opportunity to fly in an aircraft and actually manipulate the controls. The students were not just along for the ride. They actually flew the plane. But they had to accomplish some tasks before they could fly.

Robin Stoddard talked to a lot of his friends and associates and soon he had a lot of pilots, parents and local citizens as volunteers to help with the program that has grown steadily since it was started in Tucson, Arizona in 1986.

The idea behind Wright Flight is simple but powerful - if you do better in school, you get to fly a plane. The student must set a goal of improving a grade or grades, and agree to study and pass the Wright Flight History of Aviation class with at least an 85% average.

Some history of aviation classes are taught by the regular classroom teacher who has been given special classes or a workshop by Wright Flight volunteers. Most classes are taught by people like Major Robin Stoddard or civilian pilots in the community like women pilots who are members of the Ninety Nines organization or by Civil Air Patrol pilots, airline pilots or others. Some classes are taught by other people like air traffic controllers, aircraft maintenance technicians or other aviation workers.

WRIGHT FLIGHT

There are usually ten (10) classes - one each week. Eight of the classes are each detailed learning sessions on aviation history. The ninth class is a review and the tenth class is the written examination. Special student notebooks and study materials including video tapes for teaching the various classes are provided by Wright Flight.

The following excerpts from a Wright Flight brochure help explain more details of the program.

WRIGHT FLIGHT Helping Kids Reach New Heights

WRIGHT FLIGHT STRESSES TO YOUNGSTERS:

> If you are sharp enough to ride and fix your bicycle, you are sharp enough to fly a plane or excel at whatever you choose to do in life.

WHAT IS WRIGHT FLIGHT?

Wright Flight is a tax-exempt, non-profit organization named after Orville and Wilbur Wright. We believe the Wright brothers' example of setting goals and achieving them through hard work and discipline is relevant to today's youngsters.

We offer students a unique opportunity ...

... IF YOU DO BETTER IN SCHOOL, YOU GET TO FLY A PLANE.

The positive self-esteem generated by setting goals and meeting them in order to earn the right to fly a plane is tremendous. The early exposure to aviation broadens the horizons of students. It shows them that working harder in school has positive, tangible results. Even if they do not go on to an aerospace career, the thrill of achievement and of flying has a lasting impact.

HOW DOES A STUDENT EARN A FLIGHT?

A student must fulfill the Wright Flight contract. This contract has two clauses. First, they must pass the Wright Flight History of Aviation course. Secondly, they must do better in some specific school area as defined by them and their teacher.

Only if the student fulfills the contract do they get the opportunity to fly a light aircraft.

WHAT IS THE COST TO THE STUDENT?

The flight experience is free of charge to the student. After taking to the skies the student receives a commemorative T-shirt and certificate. Education and flight expenses are covered by donations. (Wright Flight covers the fuel expense of volunteer pilots. Other aircraft expenses, including insurance, are covered by the aircraft owner.)

RESPONSES

From Students

"I feel great .. not only have I achieved more than my previous goal, but my outlook is better and I have more confidence in myself."

"I really enjoyed flying with you. I learned many things about flying. My favorite thing about our flight was when we did those turns. I just want to thank you for probably giving me the best time of my life."

"The reason I joined Wright Flight was to have something that would make me push myself to reach my goal and to raise my chemistry grade from a 'C' to a 'B' and I accomplished my goal."

"When I was given the opportunity to earn a flight lesson I jumped at the chance because I felt I would never get another opportunity such as this again. Being in a wheelchair has its limitations, but this is one time that my limitations didn't get in the way of my progress."

From Parents

"... thank you for the wonderful experience you provided me for my daughter and her classmates. It was quite a thrill to see kids having opportunities such as flying, expanding their horizons and thought processes."

" ... thank you Wright Flight for all that you have done to encourage and inspire our son ... He has made a 180 degree turn for the better since enrolling in the program. He now expresses confidence and enthusiasm about his future."

" ... it was amazing to see the look on my daughter's face after she got out of the plane. I think she's kept a part of that enthusiasm in her in all her schoolwork since the flight."

From Teachers

"My students are in desperate need of sources of motivation and achievement, which can actually play a role in their future. I saw the program actually motivate students to achieve higher personal and academic goals. I was impressed!"

"We are constantly looking for ways to reach both ends of the academic spectrum and to motivate the unmotivated, challenge the unchallenged. In a small public school this is not always easy. Wright Flight has shown me one way to meet this demand. It served not only to meet the requirement, but surpassed my expectations!"

"The students were highly motivated and enthusiastic about the flight at the end of the course."

"I was enthusiastic right from the start when I heard that the flight was to be strictly an earned reward. It is all too common that modern children are given challenges and then are rewarded for half-hearted attempts. In Wright Flight, I was able to promise them and their parents that no one would be told: 'Well, you got close to the passing score, so we'll let you fly even though you didn't really earn it.' For the students who made it, there was the knowledge that it was all their own actual accomplishment, and their pride was the greater for that."

The following material is taken from the first page of the notebook material each student is given.

WELCOME TO THE WORLD OF WRIGHT FLIGHT!

Wright Flight, Inc. is a program named after Orville and Wilbur Wright. Consider for a moment what these two bicycle mechanics from Ohio accomplished. They changed the world because of their invention. They introduced to mankind the age of aviation. Their discipline, hard work and resourcefulness produced the first controlled flight of a heavier-than-air flying machine. Theirs was a process of experimentation, of trial and error, of testing, failing and, ultimately, succeeding. It was a model of achievement.

The Wright brothers, unlike other inventors of the day, had no government backing, no large corporate sponsors. But they had a dream, a goal and the desire and discipline to achieve. The Wright brothers have been called **Doers with Dreams**. The Wright Flight program allows you to be a doer with a dream as well.

Just as the Wright brothers ushered in a world of aviation to all mankind, Wright Flight wishes to introduce you to the aviation opportunities in your world. The need for men and women in the aviation industry will be exceedingly great in the coming decade. The aviation and aerospace fields need people! Pilot and mechanic shortfalls are predicted in the 1990's and beyond. People are needed to run airports, air traffic control facilities, air express delivery services ... the list could go on and on.

This program introduces you to many jobs you can get in the aviation and aerospace fields. First, it will allow you to learn about the history of aviation. You will learn about famous aviators from all walks of life who kept striving despite setbacks. You will learn about air battles lost and won.

The Wright Flight program is based on a contract that has two clauses. Fist, you must pass the Wright Flight History of Aviation class with at least an 85% average. Second, you must do better in some school area as defined by you and your teacher. If you fulfill the contract you get to pilot a plane. (Not just sit in an airplane and experience a flight. You will get to take over the controls and actually get to pilot the airplane.) You will also receive a commemorative T-shirt and certificate.

The next time you see a commercial or military aircraft flying overhead, ask yourself this: "Is the pilot male or female? Is he or she an Indian, Hispanic, Caucasian, African or Asian American? Is he or she tall, short, fat or thin? Was she popular in school? Was he good in sports or awkward?" The pilot in that airplane could come from any walk of life ... in other words that pilot could be you. The same questions would apply to the people behind the scenes: the mechanics, the refuelers, the air traffic controllers, the administrators, the baggage handlers, etc.

The one thing you might be able to safely say about the pilot is that chances are he or she had an early interest in aviation. Wright Flight hopes this program might stimulate your interest in the aviation field. At the least you are in for an experience that you will always remember ... the time you first flew.

So strap on your seatbelt and get ready to takeoff and welcome to the World of Wright Flight.

The ultimate proof of the benefits of the Wright Flight program may be noted in terms of the numbers of schools adopting the program and measurable results achieved by the students.

By early 1993 thirty-five (35) schools in Tucson, Arizona were using the Wright Flight program. Nearly 1,500 students had passed the tests and earned the opportunity to fly an aircraft. The Tucson schools are: twenty-three (23) elementary, eleven (11) middle and eight (8) high schools.

In a typical school, such as shown below, students demonstrate their ability to set a goal, contract to achieve it and do it.

In the Spring of 1992 Wright Flight students at a local elementary school reached new heights through the power of motivation.

	Goal Achieved	Student
1.	Social Studies: D to C	Serena A.
2.	Spelling: F to D	Jason B.
3.	Math: B to A	Nicholas B.
4.	Reading: B to A	Andrew B.
5.	Math: B to A	Curtis C.
6.	Spelling: F to D	Matthew C.
7.	Science: B to A	Crystal C.
8.	Math: B to A	Michael D.
9.	Science: B to A	Michael F.
10.	Math: B to A	Preston F.
11.	Social Studies: B to A	Melody G.
12.	Social Studies: B to A	Lisa G.
13.	Science: C to B	David H.
14.	Science: D to C	Michael H.
15.	Math: B to A	Alisha H.
16.	Math: C to B	Brandon H.
17.	Science: B to A	James J.
18.	English: C to B	Reginald J.
19.	Spelling: B to A	Kelly L.
20.	Social Studies: B to A	Tamara M.
21.	Science: B to A	John P.
22.	Social Studies: C to B English: C to B	Sabrina P.
23.	Science: B to A	Jeff S.
24.	Spelling: F to D	Shawn T.
25.	Spelling: D to C	Tara T.
26.	Social Studies: B to A	Shauna T.
27.	Social Studies: D to C	Wayde W.

Another important function that the Wright Flight program performs is giving students an opportunity to learn about what it takes to prepare for and seek a career in aviation. Many of the volunteer teachers and people who assist in the airport visits and fly days represent excellent role models. Young women and minority students regularly express surprise to find that they can enter an aviation career if they set that as a goal.

Clearly, the Wright Flight program is making a significant difference on the lives it touches. The program has the potential to be established in many communities to serve many thousands more young people. It is readily adaptable in elementary, middle or high school.

The program is already in operation in Massachusetts and more are expected to be started in the near future in Texas, California, Tennessee and Panama. Any teacher, parent, FAA Aviation Education Counselor or other interested person can obtain information on how to start a Wright Flight program by consulting the Resources Section of this publication.

OPPORTUNITY SKYWAY - BUILDING A COALITION OF COMMUNITY SUPPORT FOR AVIATION EDUCATION

CARLTON E. SPITZER

Carlton Spitzer personifies what one motivated, dedicated individual can do to help youngsters learn via aviation education. His own early experience when he became a pilot at age 17 helped him see what a flight experience can do to help youngsters learn. He has concentrated his efforts on drop-out prevention and aviation career development especially for minority, disadvantaged and disabled students.

Following are excerpts from Carlton Spitzer's first person account of how, why and with whom he started OPPORTUNITY SKYWAY.

You asked how I got started with OPPORTUNITY SKYWAY. Started is the key word. I've organized many projects over the years, and turned them over to organizations for continued management if they proved useful. That was my intent here, to organize the drop-out prevention and career development, aviation-specific program, conduct an experimental project in the summer of 1990, and, if it were successful, to let appropriate groups carry it on. I always sound out the ideas of respected colleagues before I embark on any venture, and I did so in this instance, as you know. But it was not in my imagination that I would be so deeply involved in the day-to-day management and future planning of the project three years later.

This is the way it happened.

I was doing drop-out prevention work for WAVE, Inc. and the Prince George's [County, Maryland] Private Industry Council. It struck me that aviation could be introduced to make the classroom more relevant and exciting to minority, disadvantaged and disabled kids - indeed, to all kids - especially in the teaching of math, science, communication and geography. One thing seemed clear from the start: if the experiment worked, we should operate twelve months a year. As a pilot (since age 17 in high school) I have seen many exciting summer programs crash on the rocks of teacher indifference when the kids returned to class in September. It isn't enough to excite interest. Interest must be sustained.

We recruited 21 kids from Du Val High School's [a Prince George's, Maryland school] cafeteria on final examination day, 1990, with the help of three black flight instructors, Lloyd J. Coleman, Jr. Ted Robinson and Bob Barton. Of the 21, only two had ever considered careers in aviation, and three told us they didn't intend to return to Du Val in September. We taught a private pilot ground school (Coleman and Roland Butler). One morning each week (of the five weeks) we brought in role-model speakers from every job we could think of in aviation: piloting, air traffic controlling, flight services, a host of ground services, weather forecasting, administration, security, line service people at small airports, and more. Another morning each week we took the kids to aviation facilities: Baltimore-Washington International Airport (BWI), small airports, the Air and Space Museum. One day we took them flying. They handled the controls. And, for a few of these kids, it was a life-changing experience. One, who had his head on the desk the first few days of class, was transformed. He had said he would not return to school. Not only did he return, he passed the Federal Aviation Administration (FAA) examination at the end of the course and became downright civil. Today, he is in his second year in the Airway Science program at the University of Maryland, Eastern Shore, and doing well.

Of the 21 kids, 19 stayed the five weeks, 16 took the FAA examination, 5 passed, 5 missed by one or two questions, and every kid returned to school. We started an OPPORTUNITY SKYWAY Club. The kids elected their own officers. The principal gave us a club room. We decorated it with materials given us by the Aircraft Owners and Pilots Association (AOPA), FAA and the Air and Space Museum. We continued monthly tours of aviation facilities, role-model speakers, and introduced career nights for students and parents. Later, we built a strong board and advisory committee, developed a one-on-one teacher partner program in which teachers can call on THEIR professional in aviation for special projects, films, speakers and curriculum development. Our board members and advisory committee members serve as mentors to the kids. We inaugurated a course, "Introduction to Careers In Aviation" during the school year (for credit), and continued the summer private pilot ground school. The Private Industry Council (PIC) agreed to continue to fund the program, including 15 hours of start-up flying instruction for kids who passed the FAA examination. Tours became more diverse, and more helpful. Example, a tour of Air Force 2 at Andrews Air Force Base (AFB) surfaced as much interest among the kids for preparing food in the galley and maintaining the aircraft as flying the 707, or commanding its sophisticated radio equipment. The students find their own level of interest - and we treat every task with great importance, and stress that it takes a team effort to prepare a plane for flight, and assure a safe and comfortable trip for all concerned.

The Prince George's County School Superintendent, then Dr. John Murphy, loved the program. Joseph T. Puhalla, president, Prince George's Private Industry Council, Inc. (PIC), became a strong advocate as well as an essential funder. Friends at Georgia Tech took a look and decided they wanted a program there, and our affiliate network took shape. In 1991, we inaugurated the identical program in two high schools in Atlanta, with summer programs at Georgia Tech and Peachtree Dekalb Airport. That program has been renewed. Of the 31 kids who enrolled in the initial Atlanta program, 15 are in college, and 10 are in technical school.

We started an affiliate on Maryland's Lower Shore the same year, in three counties. And in 1992 we started up affiliates in Woodside, Delaware and Palm Springs, California. We've just received a purchase order from Nevada Business Services in Las Vegas, making official the start-up of OPPORTUNITY SKYWAY of Nevada. And we're in serious discussion with people in Richmond, Virginia, Pittsburgh, Pennsylvania, Memphis, Tennessee and Boston, Massachusetts about establishing others. In each case, a coalition effort is required: public schools, private industry councils, fixed-base operators (FBO's), aviation associations, business leaders.

We've formed official partnerships that have been tremendously helpful in setting up affiliates, conducting annual student-teacher aviation career fly-ins, career nights, teacher seminars, tours, and introductory flights: the AOPA, FAA, National Association of State Aviation Officials (NASAO), Organization of Black Airline Pilots, Civil Air Patrol (CAP), Negro Airmen

International (NAI), Air Force Association (AFA). Soon we expect to have additional partnerships with the Ninety-Nines and Tuskegee Airmen.

Why am I still with it? Because I have been caught up in it, and without money to staff or contract. I am it. It has consumed my time, energy, imagination. I am pleased it is moving forward and anxious to move it faster. I have proposals pending with major foundations, and I am constantly looking to strengthen our partnerships, board of directors and advisory committee. We are fortunate to have an amazingly effective volunteer vice president in California, David Switzer, a former Navy Commander, and Air Transport Pilot (ATP) who retired from the FAA a few years ago. He is doing a great job in California and Nevada.

Any school or community that wants to consider establishing an OPPORTUNITY SKYWAY program should study their Affiliation Agreement. Excerpts from that agreement provide details of what the program is designed to do and what is expected of the local organizations along with what the headquarters organization will do. While there is a cost to establishing and operating the program, in many cases local Private Industry Councils and other groups and individuals are potential sponsors of the program.

Following are relevant excerpts from the Affiliation Agreement:

AFFILIATION AGREEMENT

A. STATEMENT OF PURPOSE AND OBJECTIVES

OPPORTUNITY SKYWAY, Inc. is a nonprofit 501 (c) (3) (pending) corporation organized to motivate students - especially minority and disadvantaged students - to stay in school, develop an interest in learning, increase their self-confidence and self-esteem and focus on a career choice in aviation.

The Opportunity

The aviation industry has doubled in size in the past twenty years and despite the demise of old-line carriers and a general economic recession, aviation forecasters predict a job growth rate of between five and eight percent (5% and 8%) annually into the 21st century. In general aviation, executives are concerned with maintaining and upgrading aircraft and ground support facilities, and need motivated, qualified workers. There are abundant and diverse opportunities in aviation for students willing to prepare themselves by completing high school and acquiring either a two-year technical degree in one of the aviation specialties, or a four-year airway science degree.

The Situation

The high school drop-out rate across the nation continues to put thousands of untrained and largely unemployable people on the street every year. Teachers, school counselors and education administrators need help in motivating youth - especially "at risk" youth - to stay in school and focus on career possibilities. Leaders in business, education and government must be brought together in practical coalitions to help make the classroom more relevant, exciting, fun and career-oriented. OPPORTUNITY SKYWAY provides one innovative, imaginative aviation-related program through which such coalitions can be formed and managed.

The Methodology

OPPORTUNITY SKYWAY brings aviation to the classroom and students and teachers to the aviation workplace. Role-model speakers, teacher partners, teacher seminars, tours of aviation facilities, student mentors, in-school clubs, summer internships, summer private pilot ground school, monthly orientation flights, start-up flying instruction for those who qualify and career days are employed with other special events to inform teachers and parents, and excite and motivate students. Volunteers from the aviation industry play a key role in program implementation. Tours, for example, include fixed base operators, airlines, maintenance facilities, flight dispatching, air traffic control, weather, and airport management and security. Visibility for the coalition's efforts is enhanced through national distribution of a quality newsletter, OPPORTUNITY SKYWAY News, a quality traveling exhibit, a pocket-size brochure, and three videos, each geared to a different "market."

The programs are operated twelve months a year. Affiliate programs follow the basic concept, purpose and objective, but are free to revise and augment methodologies to meet their own goals and aspirations.

OPPORTUNITY SKYWAY works with and through public school systems, in concert with teachers and administrators. It schedules face-to-face meetings for students and teachers with professionals in every field of aviation. Tours enable students to talk with people performing their tasks, and ask questions that might not occur to them in a classroom. Briefings, seminars and orientation flights for teachers and counselors increase faculty awareness and enthusiasm, which are conveyed to students day-to-day in the classroom.

An annual state-wide Aviation Careers Briefing "Fly-In" in Maryland is organized and managed by OPPORTUNITY SKYWAY. Invitations to educators and students are extended by the State Chief School Officer through the district superintendents who identify interested students and teachers. Volunteer pilots are recruited by OPPORTUNITY SKYWAY to transport students and teachers to and from the host airport (location of "fly-in" briefing). A briefing on job opportunities, a tour of airport facilities, luncheon, door prizes, and the flights to and from home airports make this an outstanding fun-education day. A safety seminar is conducted by the AOPA at the host airport for participating volunteer pilots.

Through these methodologies, OPPORTUNITY SKYWAY links school curriculum with the reality of the workplace, and provides a path from secondary school to two-year specialty technical programs, and four-year airway science degree programs.

All students interested in aviation are encouraged to participate. Special attention is given to "at-risk" students to help them meet their individual challenges, stay in school and focus on learning and careers of their choice.

B. STANDARDS FOR AFFILIATE OPERATIONS

I. AFFILIATE will: plan, organize and manage a year round program with and through one or more public schools, in cooperation with school administrators and teachers.

II. AFFILIATE will: develop a local (area) coalition of interested parties (aviation executives, heads of institutions of higher education, business groups, civic leaders, others) to support and participate, and serve as board members and advisors.

III. AFFILIATE will: maintain program integrity and financial accountability, and report progress and problems to OPPORTUNITY SKYWAY in a timely manner.

IV. AFFILIATE shall: develop and sustain a flow of information to interested community/education partners/participants to assure public awareness and community support. AFFILIATE is invited to submit bylined articles covering its activities, with good quality photographs, for publication in OPPORTUNITY SKYWAY News.

C. SERVICES TO AFFILIATE PROVIDED BY OPPORTUNITY SKYWAY

I. OPPORTUNITY SKYWAY shall provide organization, technical and marketing assistance to the AFFILIATE in establishing a coalition, building a board of directors and advisory committee and designing a year round start-up program in the schools, in cooperation with teachers and school administrators.

II. OPPORTUNITY SKYWAY shall provide 300 copies of each issue of its newsletter, OPPORTUNITY SKYWAY News, without charge, and shall add names to its national mailing list provided by the AFFILIATE. Additional copies of the newsletter may be purchased by the AFFILIATE at cost.

III. OPPORTUNITY SKYWAY shall make its national exhibit available to the AFFILIATE and, if desired, provide a replica at cost, tailored to the needs of the AFFILIATE.

IV. OPPORTUNITY SKYWAY, upon invitation from the AFFILIATE, shall schedule a meeting of its national board of directors at the AFFILIATE'S location, in conjunction with a meeting of the AFFILIATE'S board of directors.

V. OPPORTUNITY SKYWAY shall, upon invitation of the AFFILIATE, help plan and participate in the AFFILIATE'S Career Days (for students, teachers, parents), Aviation Roundtables (for participants from business, aviation, and economic development), and media events (speaking platforms), interviews, editorial board meetings and special events.

VI. OPPORTUNITY SKYWAY, in cooperation with the AFFILIATE's staff and board of directors, shall conduct an annual review of the AFFILIATE's program.

STARBASE

BRIGADIER GENERAL DAVID T. ARENDTS (ANG)
MAJOR RICHARD J. "RICO" RACOSKY (ANG)
MS. BARBRA L.S. KOSAK - EDUCATOR

This program is the result of actions by individuals who joined forces to create a program that came from the ideas of each of them. Each of the three co-founders of STARBASE Youth Program brought separate but essential elements together to yield a truly synergistic result. As the founders of STARBASE put it, the mission of this program is:

> "to add value to America through youth programs that focus on science, math, drug demand reduction, and goal setting skills."

The purposes of STARBASE are:

- Provide students and teachers with an exceptional center for "hands-on" science, math, drug demand reduction (DDR) and goal setting programs.
- Our primary focus is 4th through 6th grade children, with special emphasis on reaching out to minorities, females and at-risk children.
- Develop strong self-esteem and positive attitudes through mastering goal setting skills using the **dreams + action =Reality** program (d + a = R).
- Train teachers to demonstrate in the classroom practical and interesting science activities that will inspire young people to pursue careers in science and mathematics. (Possible accreditation through Oakland University for teacher training - 4 graduate credits).
- Create partnerships with the military, industry and education to jointly pursue solutions to our nation's science, math and alcohol/drug abuse crisis.
- Provide assistance to parents and encourage them to get involved in their community's educational programs.
- Provide career motivation, orientation, exploration and preparation.

This program includes several modules or separate projects.

Project Stars is a one week class for 4th to 6th grade students. The classes are held in facilities at the Selfridge Air National Guard Base in Michigan. Classes are held from 9:00 a.m. to 2:00 p.m. A typical five-day schedule is shown below.

Monday - Introduction, Mission Assessment, Team-Building Activity, Ocean of Air
- Lunch -
d + a = R, Hydroponics Activity

Tuesday - Aircraft Control Surfaces, Aircraft Instrumentation, Model Rocket Construction
- Lunch -
Newton's Laws of Physics Experiments, Hydroponics Investigation

Wednesday - Glider Construction, Computer Simulations, Shuttle Science
- Lunch -
"Liftoff" Video, Computer Simulations, Hydroponics Investigation

Thursday - Astronomy/Sun Tracking Computer Labs, Model Rocketry Safety & Preparation, Coast Guard Tour
- Lunch -
Reaction Time Simulation, Model Rocket/Glider Launches, Hydroponics Conclusions

Friday - Base Tour
- Lunch -
Base Tour, Graduation

References to a program element or curricular topic shown as d + a = R is a concept and program developed by Major Racosky. This element of the STARBASE program is very important and unique as far as other aviation or aerospace education programs are concerned. It is a concept that merits study by those with existing programs that could benefit by adapting and using it. The d + a = R program is described below.

The **dreams + action = Reality** program gives youth a proven, step-by-step, easy-to-use system for learning what they must know to succeed today - how to pinpoint personal goals (**dreams**) and then follow through with positive **action** to make their goals **Reality.**

dreams + action = Reality also helps youth:

- Build self-esteem.
- Become self-starters.
- Develop success habits that last a lifetime.
- Increase self-confidence.
- Take responsibility.
- Make decisions.
- Overcome fears.
- Discover new talents and skills.
- Sharpen academic and athletic abilities.

We can't completely protect our youth from today's enormous pressures of growing up, but we can help them face these pressures by showing them how to make positive choices - a skill developed through knowing the principles of how to set and achieve goals.

dreams + action = Reality is also available in book form (see Bibliography). The Action Text communicates with youth in seven ways:

1. Heart-to-heart writing style.
2. Reader-friendly text.
3. Actiontext: Addresses hot issues like personal potential, fears, choices and responsibilities.
4. ActionGraphics daily planning graphics make it easy to form success habits.
5. Though-provoking exercises.
6. Contemporary layout: Fun illustrations, stamp-style messages, easy-to-understand charts and diagrams, mezzotint-style photos.
7. Margin quotes: Summarize key ideas for immediate recall.

A curriculum summary of the STARBASE instructional program includes seven modules:

d + a = R
Teamwork
Skills Development
Math
Science
Drug Demand Reduction (DDR)
Base Tour

The STARBASE program seeks to educate the whole child and the three categories emphasized with the topics taught are shown below:

MIND Purpose: To "add value to America."

Science - Math - Technology - Drug Demand Reduction Program d + a = R* - Goal Setting Skills - Self-Esteem Development.

ENVIRONMENT Purpose: Saving the Earth for our future.

Importance of recycling - Hydroponics: comparison of plant life with proper food versus plant life on drugs - Personal /Community Environmental Goals.*

BODY Purpose: Drug use is life abuse.

Importance of good physical fitness through exercise - Importance of good nutrition through eating healthy and staying drug free - Personal Physical Goals.*

*dreams + action = Reality

A significant special project and program conducted by the STARBASE staff is a one week program where the participants live on the base. This is for older children who have special needs. This program, known as YESS, stands for Youth Employment Support System and is designed for minorities, females and at-risk youth. the areas of concentration, clienteles and program objectives are shown below.

YESS Program Objectives

- Provide students with positive peer interaction; strengthen positive aspects of the peer group.
- Provide self-esteem and goal setting skills. Students will be trained to take positive action toward their future, improve self-awareness and realize true potential.
- Provide each student opportunities to interact with caring adults and peers in a small group setting and individually.
- Provide YESS coaches for each student; Coaches will assist students with personal issues, help them make wise choices, and act as mentors.
- Provide better employment skills and opportunities.
- Help parents and students to realize their capabilities and talents, learn how to relate to others in a meaningful and satisfying way and acknowledge their preciousness and worth as human beings.
- Provide the parents with a positive involvement in the learning community with the YESS coaches and develop a closer relationship with their child.

YESS Areas of Concentration

8-13 years: d + a = R*
tutoring - character development (counselor) - social skills hobbies, sports and team activities - Project STARS

14-16 years: d + a = R*
tutoring - character development (counselor) - career exposure and team activities - ACE Academy (grades 10-11)

17-18 years: d + a = R*
mentoring - character development (counselor) - competitive employment - apprenticeships - ACE Academy (grade 12)

18-20 years: scholarship assistance
mentoring - role modeling (for entering 9-13 years) - competitive employment - apprenticeships

*Self-esteem development/goal setting skills

The STARBASE staff provides a one-week summer FAA ACE (Aviation Career Education) Academy for students in 10th - 12th grades. For these students the program includes three parts:

Classroom Instruction	d + a = R	Hands-On Experience
Flight Theory Instruments	Dreams + Action = Reality	Control Tower
Aircraft Design	Goal Setting Skills	Radar Approach Control
Aviation Maintenance	Self-Esteem Development	Avionics
Aviation Management		F-16 Simulator
Commercial Pilots (Careers)		F-16 Hangars
Military Pilots (Careers)		Coast Guard
Aviation Industry		Life Support
Aviation History		Search and Rescue Helicopters
Computer Flight Simulations		1-Hour Orientation Flight at Local Airport
		Fighter Squadron Operations

In all successful magnet programs, community resources are used and partnerships are built in the local area. Following are some of the cooperating partnerships helping the STARBASE program.

Military

The National Guard - Washington, D.C.
Selfridge Air National Guard Base, Michigan
- 127th Tactical Fighter Wing
- 191st Fighter Interceptor Group
- U.S. Air Force
- U.S. Army
- U.S. Coast Guard

Industry

Apple Computer
General Dynamics
General Motors
Morley Candy Co.
Microsoft Corporation
Kellogg Foundation
Young/Rubicam
Dale Carnegie
Detroit Compact
Northwest Airlines

Government and Non-Profit Agencies

FAA
NASA
CAP (Civil Air Patrol)
Judson Center

Universities

University of Michigan (Michigan Space Grant)
Oakland University (graduate credit for educators)

A real test of the value of any educational program is the perception of the benefits of the experience. A summary of student responses to questions about the STARBASE experience is revealing.

Question	Score
The STARBASE program has helped me better understand the relationship of math and science to everyday events.	97% agreed or strongly agreed
The STARBASE program has helped me be more comfortable with math and science topics and will help me when I take math and science classes in school.	81% agreed or strongly agreed
The d + a = R program with Rico will help me set goals and make plans for my future.	89% agreed or strongly agreed

The STARBASE program has helped me understand the need for teamwork in almost all of my activities, projects and problem solving.	88% agreed or strongly agreed

The STARBASE program has potential for replication in other localities providing that the many community resources needed are available as well as the funding support.

"In one of our previous magnet programs, fourth grade students were introduced to the scientific method through hands-on experiments. Students in this class made their own model airfoils and used miniature wind tunnels to demonstrate principles of aerodynamic lift, and then wrote lab reports on their observations and experiences in conducting these experiments. Activities such as these are very important to formulating positive student attitudes toward science as well as building their knowledge."

Alicia Coro

SECTION IX - AVIATION EDUCATION IN A TRANSPORTATION CAREERS' MAGNET SCHOOL

In Atlanta, Georgia the Walter F. George High School prepares students for careers in the growing diversity of transportation employment opportunities. Many school systems are looking at how their current and planned aviation education programs may relate to preparing young people for work in other modes of transportation.

Mr. James J. Berto, Jr. is the Instructional Coordinator at this institution which is detailed below.

INTRODUCTION

The Walter F. George Center for Studies in Transportation Careers is a major effort on the part of the Atlanta Public Schools that is designed to meet the needs of students who have aptitude, interests and aspirations relative to careers in the transportation industry. Its curriculum is structured in such a way as to offer adequate preparation for students to be highly competitive in the varied careers of the industry, while providing the relevancy in education that attracts high achievers as well as students with average abilities to the field. Instruction combines theoretical and practical experiences in a stringent four year program which will equip Atlanta students with the knowledge and skills that enable them to perform at high levels of proficiency once they are employed.

A marked advantage of the Center is its proximity to the transportation firms in the southeast quadrant of the city. Within the area, there are a considerable number of trucking firms and the Atlanta Hartsfield International Airport which serves as a valuable resource for practical and hands-on experiences that are integral parts of the program. Alliances have been established with other sectors of the transportation industry such as the Southern Railway System, General Motors Lakewood Assembly Plant, Metro Atlanta Rapid Transit Authority (MARTA), Delta Airlines and Greyhound and Gray Line bus companies.

Recent studies of the local, as well as the national transportation community, support the position of the Walter F. George Magnet program that the needs and demands of the industry are highly diversified. For this reason, the Center's complete program is based upon, what many believe to be, the largest and most productive industry in the country.

The Walter F. George Center for Studies in Transportation Careers is committed to providing a high level of educational experiences related to the transportation industry that will enable students to pursue advanced post-secondary training or to obtain substantial entry-level employment.

PHILOSOPHY

The emergence of the Magnet School concept in American public education has served to strengthen the relationship between education and the corporate community. Industry is reliant upon education to provide knowledgeable and skillful workers, whereas education is dependent upon industry to provide adequate jobs with competitive salaries for these workers.

The Walter F. George Center for Studies in Transportation Careers views as its primary responsibility one that requires broadening the minds of students with a general knowledge and interest in the field, exploring that interest and understanding and developing the necessary skills according to individual levels of achievement.

As a Magnet addressing the varied transportation careers, it is conceivable that the George Center will serve a more diverse group than any other program of its kind. Students have training opportunities ranging from navigation and flight instruction to the operation of trucks and automobiles.

CURRICULUM HIGHLIGHTS

Students are afforded the unique opportunity to combine the regular academic program with a rigorous regimen of specially formulated technical courses in the transportation areas of their personal interests. In addition, students are required to take coursework that will enhance their skills in technical writing, interpersonal relationships and personal economics.

Magnet courses which heavily interface with the Vocational Education curriculum offer specialties in the following areas:

1. Automotives (Gasoline and Diesel)
2. Aviation (Air Frame and Power Plant Maintenance and Avionics)
3. Structural Design
4. Transportation Management

Upon graduation from high school, many students will chose to attend post-secondary institutions of higher learning. For some, this choice is not made until their senior year of high school. With this in mind, the curriculum of the George Center for Transportation Careers is designed to provide the student enrolled in its program with the necessary course work and training that will qualify them for admission to either two or four year colleges and other post-secondary institutions as well. For this reason, it is mandatory for all students to successfully complete the prescribed course of study as set forth by the Atlanta and George State Boards of Education to quality for a graduation diploma. This also includes adherence to the uniform attendance policy enforced by both agencies.

The George Center offers a wide range of specialization areas. Majors span the gamut of the transportation industry and reach a greater variation of the general populace. Students receive training and educational opportunities ranging from flight instruction and the study of navigation to the operation of automobiles and trucks. Other transportation related services such as freight handling, repair and maintenance of diesel and gas engines and administrative services are also offered.

Many areas of specialization require hands-on or practical experiences. Arrangements have been made with local firms for George Center students to participate in real-life work situations that significantly augment classroom and theoretical learning. the cooperation of the business community helps to make the George program the most comprehensive of its kind.

COURSE PROFILES

Course Title: Avionics I **Course Number:** 981000

Course Description: Introduction to aircraft electronics communications, navigation and radar systems, fundamentals of electricity and electronics, the use of tools and specialized test instruments and government licensing requirements.

Course Enrollment Guidelines:

A. Prerequisites: 15 semester hours of Drafting
7 1/2 semester hours of Metal Technology
7 1/2 semester hours of Electronics

B. Recommended Class Size: 15 to 25 students

C. Recommended Grade Levels: 11th and 12th

Pupil Characteristics:

A. Students should have similar backgrounds and levels of capability of other students entering the program.

B. Students should exhibit some evidence of maturity and seriousness of purpose.

C. Students should be well prepared in general course material (reading, writing and mathematics).

D. Students should have high levels of aspiration and display the motivation and assertiveness to achieve the maximum in a difficult program.

Teacher Characteristics:

A. Teachers must be knowledgeable of subject matter involved.

B. Teachers must have working knowledge of manipulative skills and theory for the preparation of instructional materials.

C. Teachers must be able to relate the significance of coursework to industry expectations.

For each of the following Course Profiles the **Course Enrollment Guidelines, Pupil Characteristics** and **Teacher Characteristics** are the same as shown above.

Course Title: Avionics II **Course Number:** 981010

Course Description: Theory of operation, installation, troubleshooting and maintenance of LF, HF, VHF, UHF, radio communication and ICS systems using advanced test procedures and specialized test instruments.

Course Title: Avionics III **Course Number:** 981020

Course Description: Study of standard air navigational aids including commercial airliners and small aircraft systems. Theory of operation, installation and maintenance of guidance and landing systems utilizing specialized tools and test instruments.

Course Title: Avionics IV **Course Number:** 981030

Course Description: Advanced study of aircraft radar systems including weather and terrain-mapping radar, radar antennas and wave guides, the operation, installation, maintenance and repair techniques utilizing advanced state of the art tools and test instruments.

Course Title: Aircraft Mechanics I **Course Number:** 981040

Course Description: Introduction to the theory, principles and methods of aircraft maintenance with special emphasis on tools, trouble-shooting techniques and safety.

Course Title: Aircraft Mechanics II **Course Number:** 981050

Course Description: Servicing and repairing of airframe structures and assembly of major components of aircraft.

Course Title: Aircraft Mechanics III **Course Number:** 981060

Course Description: A study of the principles of generation, circuit protection devices and other components of the aircraft electrical system.

Course Title: Aircraft Mechanics IV **Course Number:** 981070

Course Description: Internship in selected or facility actively involved in aircraft maintenance.

Course Title: Diesel Mechanics I **Course Number:** 981080

Course Description: Introduction to Diesel Mechanics safety, use of tools, theory, electrical system for starting, micrometer measurements and identification of parts.

Course Title: Diesel Mechanics II **Course Number:** 981090

Course Description: Disassembly, parts, replacement, knowledge of determination and wear using measurement, tools, parts cleaning and adjustments.

Course Title: Diesel Mechanics III **Course Number:** 981100

Course Description: Complete overhaul of engine including rings, inserts, gaskets, valves and other parts necessary for engine reassembly according to the specifications of the manufacturer.

Course Title: Diesel Mechanics IV **Course Number:** 981120

Course Description: On-the-job training in local shops, dealing with diesel powered vehicles.

Teacher Characteristics: In addition to those cited above for all teachers and courses, the teachers of this subject must have a working knowledge of manipulative skills and theory for the preparation of instructional materials.

In Walter F. George High School there are two curricular approaches. One is for those students planning to prepare for college and the other is for those pursuing vocational education.

The four year plan for each of these follows.

TRANSPORTATION MAGNET
COLLEGE PREPARATORY CURRICULUM
FOUR YEAR PLAN OF STUDY

First Semester	Second Semester
9th Grade	
English	English
Mathematics-Algebra	Mathematics-Algebra
Science-Matter & Measurement	Science-Energy & Measurement
Social Science-Political Behavior	Social Science-Intro To Econ.
Physical Ed. - Physical Fitness	Physical Education
Transportation Orientation	PECE
10th Grade	
English	English
Mathematics-Algebra	Mathematics-Algebra
Science-Biology	Science-Biology
Social Science-World History	Social Science-World History
Foreign Language-Spanish	Foreign Language-Spanish
Keyboarding or Industrial Technology	Keyboarding or Indus. Tech.

11th Grade

English	English
Mathematics-Geometry	Mathematics-Geometry
Science-Physics	Science-Physics
Social Science-U.S. Democracy	Social Science-Modern U.S.
Foreign Language-Spanish	Foreign Language-Spanish
Magnet Specialization: (Choose One)	Magnet Specialization: (One)
Aircraft Mechanics	Aircraft Mechanics
Automotive Mechanics	Automotive Mechanics
Diesel Mechanics	Diesel Mechanics
Drafting	Drafting
Marketing	Marketing
Business	Business

12th Grade

English	English
Elective (Private Pilot Ground School)	Elective
Computer Technology/Fine Arts/ Vocational Ed/Jr. ROTC	Computer Technology/Fine Arts/ Vocational Ed/Jr. ROTC
Health-Health Seminar	Elective
Magnet Specialization: (Choose One)	Magnet Specialization: (One)
Aircraft Mechanics	Aircraft Mechanics
Automotive Mechanics	Automotive Mechanics
Diesel Mechanics	Diesel Mechanics
Drafting	Drafting
Marketing	Marketing
Business	Business

TRANSPORTATION MAGNET
VOCATIONAL EDUCATIONAL ENDORSEMENT: CORE CURRICULUM
FOUR YEAR PLAN OF STUDY

First Semester	Second Semester
9th Grade	
English	English
Mathematics-Algebra	Mathematics-Algebra
Science-Matter & Measurement	Science-Energy & Measurement
Social Science-Political Behavior	Social Science-Intro to Econ.
Physical Ed.-Physical Fitness	Physical Education
Transportation Orientation	PECE

10th Grade

English	English
Mathematics-Algebra	Mathematics-Algebra
Science-Biology	Science-Biology
Social Science-World Hist./Studies	S.S.-World History/Studies
Introduction to Technology	Transportation & Power
Keyboarding/Technical Drafting/ Electronics	Keyboarding/Technical Drafting/Electronics

11th Grade

English	English
Mathematics-Geometry	Mathematics-Geometry
Science-Physics	Science-Physics
Social Science-U.S. Democracy	Social Science-Modern U.S.
Magnet Specialization: (Choose One)	Magnet Specialization: (One)
Aircraft Mechanics	Aircraft Mechanics
Automotive Mechanics	Automotive Mechanics
Diesel Mechanics	Diesel Mechanics
Drafting	Drafting
Marketing	Marketing
Business	Business

12th Grade

English	English
Elective (Private Pilot Ground School)	Elective
Computer Technology/Fine Arts/ Vocational Ed./Jr. ROTC	Computer Technology/Fine Arts/ Vocational Ed./Jr. ROTC
Health-Health Seminar	Elective
Magnet Specialization: (Choose One)	Magnet Specialization: (One)
Aircraft Mechanics	Aircraft Mechanics
Automotive Mechanics	Automotive Mechanics
Diesel Mechanics	Diesel Mechanics
Drafting	Drafting
Marketing	Marketing
Business	Business

For those students who wish to qualify for the FAA Private Pilot Written Examination a video-based ground school course is offered. The detailed course profile of this course follows:

Course Title: Private Pilot Video Ground School Course

Course Number: 981140

Course Description: This video ground school course is designed to encourage students to develop and pursue an interest in aviation and to provide incentives for pursuing careers in the aviation industry. The basic video ground school course includes modules pertaining to aerodynamics, the airman's information manual (AIM), weather, Federal Aviation Regulations (FARs), instruments, engine operations, weight and balance, performance, navigation and time conversions. Role-modeling sessions with aviation professionals, aviation industry tours and orientation flights are also an integral part of the course. Upon completion of the course, students will be eligible to take the FAA private pilot ground school test.

Course Enrollment Guidelines:

Prerequisite: None

Class Size: Minimum 18; Maximum 28

Grade Level: 10-12

Pupil Characteristics:

ACADEMIC BACKGROUND/SPECIAL TALENTS: This course is specifically designed to provide interested Transportation Magnet students with the information necessary to prepare for the FAA private pilot ground school test.

Teacher Characteristics:

The teacher should be an FAA certified ground school flight instructor.

Texts:

Aviation Training Center, Inc. PRIVATE PILOT COURSE MANUAL. Golden, Colorado, 1990.

Kroes/Rardon/Bent/McKinley. AIRCRAFT BASIC SCIENCE, 6th Edition. Gregg Division/McGraw-Hill Book Company, 1988.

OUTLINE

I. Introduction

- A. Course Purpose/Objectives
- B. Career Orientation
- C. Student/Teacher Expectations

II. Aerodynamics

- A. Angle of Attack/Angle of Incidence
- B. Relative Wind
- C. Center of Pressure
- D. Lift/Drag/Thrust
- E. Weight/Center of Gravity/Load Factor
- F. Forces Affecting Flight
- G. Stall Speed
- H. Axes of an Airplane
- I. Adverse Yaw
- J. Flaps and Spoilers
- K. Stability
  - 1. Positive
  - 2. Static
  - 3. Dynamic
  - 4. Neutral
  - 5. Negative
- L. Lift/Drag/Aspect Ratios
- M. Wing Platform
- N. Torque/Rigging/Slipstream Effect/"P" Factor

III. Airman's Information Manual

- A. Flight Plans
- B. Flight Service Station (FES) Facility
- C. Traffic Patterns
  - 1. Standard
  - 2. Non-standard
- D. Wind Direction Indicators
- E. Runway Markings
- F. Runway Lights and Rotating Beacons
- G. Visual Approach Slope Indicator
- H. "Unicom" Radio Frequency
- I. Functions of the Control Tower
- J. Radar Advisories
- K. "DF Steers"/"VOR Checks"
- L. Preflight Checks
- M. Transponder Codes
- N. Airport/Facility Directory

- O. Medical Hazards
- P. Anticollision Light System
- Q. Wake Turbulence

IV. Weather

- A. Standard Atmosphere
- B. Troposphere
- C. Tropopause
- D. Factors Affecting Changing Weather Conditions
- E. Relative Humidity
- F. Fahrenheit/Centigrade Scales
- G. Evaporation/Sublimation/Condensaton/Precipitation
- H. Unstable/Stable Air
- I. Clear Air Turbulence
- J. Cloud Families
- K. Types/Characteristics of Thunderstorms
- L. Icing Conditions
- M. Wind Shear
- N. Jet Stream
- O. Pilot Weather Reports
- P. Area Weather and Terminal Weather Forecasts
- Q. Transcribed Weather Broadcasts
- R. Special Charts
    - 1. Prognostic Charts
    - 2. Freezing Level Charts
    - 3. Severe Weather Observations
    - 4. Radar Summary Charts
    - 5. Surface Analysis Charts
    - 6. Weather Depiction Charts
- S. Winds Aloft Forecasts

V. Federal Aviation Regulations (FARs)

- A. Certification of Pilots
    - 1. Required Certificates
    - 2. Duration of Pilot Certificates
    - 3. Medical Certificates
    - 4. Replacement of Lost or Destroyed Certificates
    - 5. General Limitations
    - 6. Pilot Logbooks
    - 7. Pilot in Command
    - 8. Change of Address
    - 9. Privileges and Limitations
- B. Designation of Airways and Controlled Airspace
    - 1. Control Area
    - 2. Transition Area
    - 3. Continental Control Area
    - 4. Positive Control Area
    - 5. Airport Advisory Area

   6. Airport Traffic Area
   7. Control Zone
   8. Special VFR
   9. Federal Airways
   10. Jet Routes
   11. Terminal Control Area
   12. Terminal Radar Service Area
   13. Restricted Areas
   14. Prohibited Areas
   15. Warning Areas
   16. Military Operations Area
- C. Operation Rules For All Air Traffic
   1. Responsibilities and Authority of the "Pilot in Command"
   2. Preflight Action
   3. Flight Crew Members at Stations
   4. Alcohol and Drugs
   5. Safety Belts
   6. Parachutes
   7. Fuel Requirements
   8. ATC Transponders
   9. Aircraft Documents
   10. Oxygen
   11. Emergency Locator Transmitter
   12. Right-of-Way
   13. Aircraft Speed
   14. Acrobatic Flight
   15. Aircraft Lights
   16. Minimum Safe Altitudes
   17. Altimeter Settings
   18. Operating at Airports Without Control Towers
   19. VFR Cruising Altitude
   20. Basic VFR Weather Minimums
   21. General and Required Maintenance
   22. Inspections
- D. National Transportation Safety Board

VI. Instruments

- A. Primary Instruments
- B. Pitch/Bank/Power Instruments
- C. Altitude Indicator
- D. Turn and Slip Indicator/Turn Coordinator
- E. Magnetic Compass
- F. Compass Errors
- G. Pilot Static System
- H. Blocked Pilot Static
- I. Indicated Air Speed
- J. Calibrated Air Speed
- K. True Air Speed

- L. Ground Speed
- M. Air Speed Indicator Abbreviations
- N. Altimeters
  - 1. Altimeter Settings
  - 2. Standard Altimeter Settings
- O. Vertical Speed Indicator

VII. Engine Operations

- A. Four-Stroke Piston Cycle
- B. Pre-Ignition
- C. Detonation
- D. Detuning
- E. Air-Cooled Engines
- F. Hand Propping
- G. Carburetor Ice
- H. Fuel Injection vs. Carburetion
- I. Aviation Fuels
- J. Fueling Procedures
- K. Aircraft Electrical System
- L. Cold Weather Operations
- M. Constant Speed Propellers

VIII. Weight and Balance

- A. Empty Weight
- B. Gross Weight
- C. Maximum Weight
- D. Payload
- E. Useful Load
- F. Datum Line
- G. Arm
- H. Zero Fuel Weight
- I. Station
- J. Center of Gravity

IX. Performance

- A. Types of Altitudes
- B. Elements of Performance
- C. Nonstandard Pressure and Temperature
- D. "Time to Turn Around" Computations

X. Navigation

- A. Automatic Direction Finder
- B. Bearing Computations
- C. VOR Navigation
- D. Course Deviation Indicator
- E. Dead Reckoning Navigation

- F. True Course
- G. True Winds
- H. True Headings
- I. Variation
- J. Isogonic Lines
- K. Agonic Line
- L. Deviation
- M. Knots of Speed vs. Miles per Hour
- N. Sectional vs. WAC Charts
- O. Compass Course and Compass Headings
- P. Dead Reckoning Calculations

XI. Time Conversions

XII. Review

XIII. FAA Private Pilot Ground School Test

All students are offered an elective orientation to transportation systems course. Following is the course profile:

Course Title: Orientation to Transportation Systems

Course Number: 981130

Course Description: This course introduces students to the concept of transportation as a SYSTEM. Information includes the definition of transportation, its importance in a technological society and the role of transportation in our economy. Transportation industries, feedback methods (monitoring/navigation), final outputs and career opportunities are also introduced.

Course Enrollment Guidelines:

Prerequisite: None

Class Size: 28

Grade Level: 9-12

Pupil Characteristics:

ACADEMIC BACKGROUND/SPECIAL TALENTS: This course is specifically designed to provide 9th grade or entering Transportation Magnet students with an overview of America's transportation system.

Teacher Characteristics:

The teacher should be certified in Vocational Education.

Text:

Bohn, MacDonald, Fales, Kuetemeyer. ENERGY, POWER, AND TRANSPORTATION TECHNOLOGY. Mission Hills, CA: Glencoe/McGraw-Hill, 1986.

In addition to the regular career courses offered at Walter F. George High School, students have the Opportunity Skyway Atlanta program available to them. Details of the Opportunity Skyway have been described in Section VIII of this publication. In Atlanta the Opportunity Skyway program is administered by the Georgia Institute of Technology. It provides a range of experiences for economically disadvantaged young people.

One of the main purposes of the Atlanta Opportunity Skyway program, as it is elsewhere, is to give students a detailed look at various aviation careers and learn what is required to qualify for them.

Atlanta students are provided with internships and opportunities to meet role models in the large variety of aviation and aerospace jobs in the region.

In a recent brochure describing the Atlanta Opportunity Skyway program the following points were made:

Program Purpose

Opportunity Skyway, Atlanta is designed to give high school students "a flying start" towards careers in aviation. The program helps them to increase their knowledge and understanding of their potential for reaching set goals in an aviation-related career field. Students also are motivated to stay in school and to improve their attendance and performance based upon developing more specific career goals.

Admission

All participants of the program must be economically disadvantaged residents of the City of Atlanta and juniors or seniors (16 to 18 years of age) enrolled in the Atlanta Public Schools. Each participant must also be a U.S. citizen and all males 18 years or older must be registered with the Selective Service. Participants must also express an interest in pursuing a career in the field of aviation. Additionally, each participant must:

1. Be desirous of receiving a high school diploma;
2. Be willing to participate in the program;
3. Complete an Interest Survey and Pre-Application Form; and
4. Be able to secure parental/guardian consent to participate in the program.

The Instructional Program

All classroom activities are aviation-oriented and job-focused. Components include recognizing career paths and vocational opportunities in aviation; understanding the importance of communication skills, speaking, viewing and writing in the aviation industry; becoming aware of the basic mathematic requirements in the field of aviation; understanding the forces controlling and keeping an airplane aloft (drag, lift, gravity and thrust); and participating in an FAA-approved Private Pilot Ground School Course designed to prepare students to take and pass the FAA private pilot ground school test. Students will also be provided with direct exposure to the aviation industry via field trips, guest speakers, mentors, orientation flights and "hands-on lab activities.

The Internship Program

Students are offered internships/job-shadowing experiences in the aviation industry during school holidays and vacations. Projected sites include MARTA, the Federal Aviation Administration and Atlanta Hartsfield International Airport.

The Opportunity

The airline industry in Atlanta has doubled in size in just over the past ten years, and is expected to grow at a significant rate throughout the next decade. Job forecasters predict that hundreds of technical and nontechnical jobs will be unfilled by workers in the years ahead if today's youth are not properly prepared for these exciting, well-paid opportunities. Career possibilities include airline pilots, corporate pilots and flight instructors, as well as air traffic controllers, electronics, maintenance and computer systems technicians, airport designers and a host of other ground service positions.

Special Incentives

Students who pass the FAA private pilot ground school test are eligible to receive some free hours of flight instruction funded by the Private Industry Council of Atlanta. Minimum wage will be provided for after school activities for eligible students.

Organized and Funded By:

Private Industry Council of Atlanta
Georgia Department of Education
Georgia Institute of Technology
Atlanta Public Schools

Supporting Organizations

Private Industry Council of Atlanta
Georgia Tech
Atlanta Public Schools
Georgia Department of Education
Federal Aviation Administration
Delta Air Lines, Inc.
Department of Aviation, City of Atlanta
Civil Air Patrol
Tuskegee Airmen
Georgia Tech Air Force ROTC

Atlanta Opportunity Skyway students were recently given the following information about careers for which they may wish to prepare:

SAMPLING OF JOBS IN AVIATION/AEROSPACE

These positions and many more pay between $15,000 and $200,000 per year, based on training and experience. Many are open to high school graduates. Many more are open to students who acquire technical training in one of the aviation specialties. The best positions are open to college-trained candidates.

Less than one percent of airline pilots are black. Less than 2 percent are women. There is an overall job shortfall projection of between 5 and 8 percent into the 21st century. Therefore, there is need for the type of training which will give students - especially minority and "at-risk" students - a flying start toward careers in aviation/aerospace.

Airline Pilot, college preferred
Corporate Pilot, FAA qualified
Flight Engineer, FAA qualified
Air Traffic Controller, college preferred
Control Tower Operator, college preferred
Flight Dispatcher, college preferred
Flight Attendant, high school diploma
Flight and Ground School Instructor, FAA qualified

Reservations Agent, high school diploma
Travel Agent, special training
Aircraft Sales Manager, college preferred
Airline Passenger Sales Agent, college preferred
Air Freight Sales Agent, college preferred
Baggage/Cargo Handler, high school diploma preferred
Sky Caps, high school diploma preferred
Ground Crew member, high school diploma preferred
Aircraft Mechanic, special training
Avionics Maintenance Specialist, special training
Airline Food Preparer, high school diploma
Airport Manager, college preferred
Airport Security Officer, high school diploma
Meteorologist, college degree
Cartographer, college degree
Scientist, college required
Mechanical Engineer, college required
Aerospace Engineer, college required
Manufacturing Technician, college required
Avionics Technician, college required
Physicist, college required
Metallurgist, college required
Machinist, special training
Electrician, special training
Drafters, special training
Technical Writers, college required
Documentation Analyst, college required
Software Programmer, college required
Production planner, special training
Sales, college required
Purchasing, college required
Personnel, college preferred
Accounting, college preferred
Public Relations, college preferred
Advertising, college preferred
Industrial Relations, college preferred
Secretaries, Special Training

SECTION X - SUPPORTING FEEDER SCHOOL CURRICULUM PREPARATION

Aviation magnet secondary schools and college and university aviation programs benefit when elementary and middle schools that prepare students for them have had an exposure to aviation, space and/or transportation learning experiences. Most aviation magnet high schools work with elementary and middle school teachers in their service area and help them develop appropriate aviation-oriented learning experiences. Teachers and students from such high schools often visit elementary schools and put on aviation demonstrations for students and teachers and describe the offerings of their secondary school.

For many years thousands of elementary school teachers have used a variety of aviation activities, projects and study opportunities that range over the entire spectrum of school subjects. Many of these teachers have participated in developing aviation curriculum materials for students.

The listing of resources for aviation education in this publication identifies many sources of useful teaching materials for use at all levels of education - K through 12. Many of these materials were developed by elementary and middle school teachers and curriculum specialists.

Following are summaries of a few illustrative examples of what creative elementary school teachers have done in creating and using aviation and related scientific and technological themes to enhance learning.

The article describing these projects appeared in the Fall, 1992 issue of the Journal of Aviation/Aerospace Education Research (JAAER).

LEARNING TAKES FLIGHT: AWARD-WINNING EDUCATORS USE AVIATION TO SPARK STUDENT ACHIEVEMENT

Frank G. Mitchell

Eleven teachers from eight different states were chosen as 1991 winners of the General Aviation Manufacturers Association (GAMA) annual Award for Excellence in Aviation Education. The award honors grade school and high school teachers who bring general aviation into the classroom, either as a specific topic of discussion or as a teaching tool.

Most of the winning projects included activities spread over an entire semester or school year. From each winning entry, two or three of the most original or vivid ideas were selected for this article. Enough detail was included so that another teacher can take the ideas and develop his or her own teaching activity. Another intent of this article is to show that aviation-related themes work for all ages and kinds of learners. A summary of the award winners follows.

AVIATION TOPICS PROMOTE TEAMWORK

By Sherilynn Admire, Soldier Creek Elementary, Midwest City, OK

Sherilynn Admire designed the unit "Teaching Aerospace Skills to Kids" (TASK) for disabled and non-disabled learners at the elementary level. She used monthly themes to introduce students to topics including the history of aviation, planets, rocketry, astronauts and balloons. Two intriguing tasks were, filing a flight plan and simulating a shuttle launch.

Teams of students used aeronautical charts of the state of Oklahoma to design their own flight path. They chose their city of origin and city of destination, filed a "flight plan," and filled out "flight logs."

A semester-long study of aerospace culminated in a shuttle launch simulation. Students made mock shuttle control panels of cardboard and chose their own shuttle name and mission; they even designed a patch and wrote a flight log. Admire said, "The flight simulation was accomplished through the power of their imaginations and a taped version of pre-launch, launch and mission activities. The students learned to problem-solve while being members of a team, to cooperate with decisions and to become aware of the importance of why they need to attend school if they one day want to be scientists or astronauts."

AVIATION CONNECTS STUDENTS WITH POSSIBILITIES

By Donna Sue Combs, Horace Mann Elementary School, Shawnee, OK

Donna Combs' project "Connections" connected students with their own talents and goals while learning about aviation. Projects throughout the year included "The Great Airplane Fly-Off" in which students, teachers and guests designed and constructed paper airplanes using four different weights of paper. Airplane races were held in each weight category and winners received a "pilot license." Bulletin boards displayed photographs of the winners and their airplanes.

In "Omniplex Field Trip" students parents and teachers enjoyed a field trip to the Air and Space Museum and Omniplex at Oklahoma City. Students sat in a real cockpit and experienced simulator flights.

For "Space Tomatoes" NASA supplied tomato seeds that had orbited in a satellite for 5 years. Students planted both the space seeds and seeds that had stayed on Earth, and compared the results. They talked about different types of satellites as well as the careers of the people who flew the seeds into space.

ESL STUDENTS PRACTICE THE LANGUAGE OF FLYING

By Teresa Y. Hall, Sierra Vista Elementary, Madera, CA

Teresa Hall's "First Grade Frequent Fliers" introduces her students to the world of flight. About 75% of her students are learning English as a second language. The new aviation vocabulary is reinforced with student-made books and fun activities.

The class read the book Me and My Flying Machine by Mercer Mayer, then they talked about their own flying machines before they wrote stories with a partner. They drew pictures of their flying machines and published the stories in a class book.

In a science experiment, students played "Huff and Puff" in which they counted how many times they had to blow on an object to move it 3 feet. The results were written on a chart.

At recess time, the students enjoyed "airplane tag," which is running with the arms extended like airplane wings.

ELEMENTARY SCHOOL "SOARS SKYWARD" WITH LEARNING AND FUN

By Summitt Faculty, Virginia Stevens, Principal, Summitt Elementary School, Austin, TX

The Summitt Elementary School faculty involved all grade levels in "Soaring Skyward" with aviation-related studies.

Kindergarten - Tako-kichi (Kite Crazy)
First Grade - Up, Up and Away (Hot Air Balloons)
Second Grade - Going to Fly Now (Airplanes)
Third Grade - Ignition -- Blast Off (Rockets)
Fourth Grade - We Navigate the Sky (Navigation)

Their studies came together with a school-wide aeronautics enrichment activity. The school recruited community resource persons representing the four methods of flight and set up NASA exhibits. The activities presented for the students during their special day were a tremendous success.

"Soaring Skyward Day" opened with the Windsock Parade during which children clipped windsocks they had made in art class to the school fence. They also painted an aviation mural. Throughout the day, there were presentations by American Airlines, the Travis County EMS, Bergstrom AFB, windsurfers, stunt kite fliers and a remote control helicopter demonstration.

PRINCIPLES OF FLIGHT DEMONSTRATED WITH EVERYDAY MATERIALS

By Lois Wells, Piedmont Elementary School, Piedmont, OK

Lois Wells' "Flight Day" introduced second and third graders to the history and principles of flight, using demonstrations and experiments to help students understand sophisticated concepts. Three examples of these experiments are:

To Show That Air Takes Space

Fill a fish tank half full of water. Place one glass into the tank so that it fills up with water. Place a second glass into the water upside down so that the air does not escape. Carefully tilt the air-filled glass under the water-filled glass. By doing this you are pouring air up in bubbles. Each bubble is a small bit of air.

To Show That Air Exerts Pressure

Fill a drinking glass to the top with water. The water should spill over the top a bit. Carefully lay a cardboard square to completely cover the top of the glass. Holding the cardboard on top, turn the glass over until it is straight upside down. Stop holding the cardboard and it will stay on by itself.

To Show That Air Has Weight

Blow up and tie two balloons that are exactly the same. Tie one balloon to each end of a yard stick. Balance them. Prick one balloon with a pin. As the air rushes out, the side with the broken balloon shoots up and the side with the heavier, air-filled balloon drops down.

STUDENTS PLAN LUNAR LANDINGS

By Chuck Arnold, Clark Elementary School, Erie, PA

In Chuck Arnold's class, each student was assigned to devise a method of packaging a raw egg in a shoe box that the egg would not break when dropped from an airplane at a height of 400 feet. The students imagined that they were suppliers for a lunar colony. Space vehicles would drop the building materials to the surface rather than land on the moon. The materials shipped to the colony must be packaged so that they would not break on impact. Because of the lack of atmosphere, parachutes would be of little value, so the problem had to be solved by the method of packaging.

Students learned whether their solutions were effective when their prototypes were dropped onto the school parking lot. As a bonus, on the day of the egg drop, they observed a demonstration jump by a local skydiver.

"STAR" BRINGS AVIATION STUDIES TO RURAL SCHOOL

By Betty Banks, Leedey Public Schools, Leedey, OK

Betty Banks' students in rural Oklahoma explored aviation with her "STAR" program - "Search for Tomorrow through Aviation Resources."

STAR helped satisfy students' natural curiosity about aviation and showed how aviation will affect their future.

She used a multi-media approach, starting with the "Let's Fly" video from the FAA, and NASA films. The science unit included visits from an FAA representative who brought an airplane simulator to school. A licensed pilot allowed students to sit in a plane and observe a flight. A local veteran talked to them about helicopters. NASA's Education Specialists brought a mobile resource center to town and presented programs for both elementary and secondary students.

Students made their own air pressure demonstrations with plastic bags and straws, and designed aircraft using paper plates, styrofoam cups, plastic bottles, etc.

REAL FLIGHT IS HIGHLIGHT OF AVIATION STUDY

By Anne Collinsworth, Clark Elementary, Wichita, KS

Anne Collinsworth taught her fourth and fifth grade students about aviation, including different types of airplanes and principles of flight. They focused on the meanings in English and Spanish of a

40-word list. "But why do all this if they can't actually get in a plane?" she thought, so she arranged for students to take a real flight.

The airplane ride was sponsored by Anne and her husband, Gary, who is president of the Beech Employees Flying Club.

Students were well prepared for Flight Day. Speakers visited their class, including a mechanic and an experimental flight pilot. On the flight, not one student needed an airsickness bag. Collinsworth gave the Saturday event high marks. "I had them so prepared they weren't afraid," she said.

AIRPORT SIMULATION TEACHES TEAM SKILLS AND CAREER OPTIONS

By Mary Nell McNeese, Oak Grove Elementary, Hattiesburg, MO

In Mary McNeese's class, students applied concepts learned in Language Arts, Math, Social Studies, Art and Science to their role playing during an airport simulation. Each student chose a different general aviation career and/or aircraft to research. Working in teams they designed and constructed child-sized model aircraft.

The students designed an airport and used non-permanent spray paint to mark an outdoor playing field with runway lights and map directions. They played the roles they had researched to simulate a busy airport. After proper communication with the control tower, each "pilot's " aircraft departed, flew the assigned route and landed successfully. The AOPA Air Safety Foundation's IFR Communication Procedure Book was used as an example of correct wording. The pilots recorded their progress in their pilot flight logbooks.

HANDS-ON PROJECTS MAKE AVIATION UNIT COME ALIVE

By Susanne Paper, Lakewood Elementary School, Rockville, MD

Susanne Paper's "Airlift for Young Minds" used aviation to interrelate the learning of science, computer literacy, math, social studies, writing, art and music. The first activity was to introduce the story of flight to science students. They learned myths and the legend of Daedalus. History came alive when an actor dressed as Leonardo Da Vinci came to the school and demonstrated Da Vinci's recorded thoughts on aviation.

Students made kites and constructed seven-foot tissue-paper hot-air balloons.

Several experiments involved heating air in a bottle. A balloon over the lip of the bottle was heated and students saw that hot air made the balloon rise. Another experiment was to place the bottle in ice; they saw that the cold air condensed into the bottle. They realized that to fly their tissue paper balloons they would have to heat the air inside the balloons.

They constructed gliders from recycled styrofoam lunch trays. For a big project, they built a usable airplane desk out of plywood and donated it to the library.

AVIATION MINI-COURSE BUILDS TEAM SKILLS AND SELF-ESTEEM

By Patricia Galarce and Jim Ryan, Keystone School, Newton, MA

"Flight" was a week-long mini-course for Patricia Galarce's and Jim Ryan's students at Keystone, a small residential school that provides services for emotionally disturbed students ages 13 to 20. The course stressed peer cooperation and goals were to expose students to aviation and space, to build group skills, to provide a positive school experience and to have fun.

Each day started with one of Time/Life's videos on space. A class then introduced the day's concepts, leading into a hands-on activity. After lunch, everyone joined for the concluding activities. Students followed directions to complete projects such as gliders, hot air balloons and model rockets. They developed positive peer relationships and respect by working together on difficult tasks. The week built confidence in their own knowledge and abilities to explore ideas and develop theories.

A summary of the five 1992 GAMA Excellence in Aviation Education Award winners follows.

STUDENTS TRIM MODELS FOR BEST FLIGHT CHARACTERISTICS

Dale Slack, Winfield Middle School, Winfield, WV

Dale Slack's middle school students learned how aircraft fly by building their own balsa models and then trimming them for consistent, straight flight.

Students charted their test flights, analyzed the flight characteristics that needed correction, then trimmed their models by adjusting the ailerons or adding paper clips to the nose or tail. Most students could successfully trim their models after six flights.

GRADE SCHOOL STUDENTS "LV 2 FLY"

Elaine Regier, Sunset Elementary School, Andarko, OK

Elaine Regier's "ILV2FLY" unit introduces grade school students to aviation and space concepts. One exciting event is when Regier pilots an airplane over the school; students' reactions to her fly-by were captured on videotape.

The class also visits a local airport and students are allowed to sit in a cockpit and help with a pre-flight.

SCIENCE DETECTIVES EXPLORE FLIGHT

Lisbeth Ellersick, Glen Ridge Middle School, Glen Ridge, NJ

Lisbeth Ellersick's "What's Up" program used aviation as the motivating theme for a series of hands-on activities. Students in grades Pre K-6 explored the dynamics of flight as part of their "Science Detectives Club" sponsored by the Afterschool Child Care Program.

Students made many models and performed flight tests with them. In one unit, they created two kinds of hovercraft using 2-liter soda pop bottles and paper plates. Another unit explored the concept of torque using mini-boomerangs of various shapes. In the "Egg Glider" experiment, students constructed safety seats that would protect an egg when its glider crashed into a tree.

AEROSPACE TECHNOLOGY PROGRAM SERVES SECONDARY STUDENTS

Steven A. Bachmeyer, South Dade Senior High, Homestead, FL

Steven Bachmeyer developed a full-year Principles of Aeronautics course for his students at South Dade Senior High. The curriculum was then adopted by the Florida Department of Education as an approved course of study for secondary schools.

The program includes three courses of study:

Principles of Aeronautics
Principles of Aerospace Technology
Principles of Space Systems Engineering

Each course is broken down into twelve units of study. Hands-on learning activities are used for each unit, including a National Competition, "The Metric Glider," also developed by Bachmeyer.

AEROSPACE CURRICULUM PROVIDES LEARNING ACTIVITIES FOR GRADE SCHOOL STUDENTS

Sharon A. Lovell, Bayport Elementary School, Bayport, MN

Sharon Lovell's Aerospace Curriculum was developed for students in grades 4-6. They learn facts about the solar system and universe, are introduced to principles of flight and construct several models.

One activity was the "Plant Pamphlet" that each student created to advertise their imaginary planet. After working with an aviation time-line and viewing the filmstrip "Link-Up" from the U.S. Postal Service, students designed commemorative stamps. Two of their constructions were "Delta Darts" (available from Midwest Products, Hobart, IN) and the "MECC Paper Plane Pilot" (from ZOOM! The Complete Paper Airplane Kit by Margaret Hartelius).

Teachers interested in submitting programs for the award should write to the General Aviation Manufacturers Association, Education Office, 1400 K Street NW, Suite 801, Washington, D.C. 20005, or call: (202) 393-1500.

Want more aviation education ideas? GAMA lists several in the brochure "Activities and Resources to Use in General Aviation Teaching Units." For counselors, GAMA publishes a "Career Brochure" that gives an overview of general aviation careers. you can ask for them by writing to the General Aviation Manufacturers Association, Education Office, 1400 K. Street NW, Suite 801, Washington, D.C. 20005.

Because aviation, space and transportation topics are so heavily involved with basic and emerging technologies, innovative educators are developing magnet offerings in a wide range of themes and topics. An outstanding example of this is described by Peter A. Fulcer, Director, Vocational Education, Loudon County Virginia Schools.

Note how these technology-based studies prepare young people who will go on to high school and be ready to understand and accept responsibilities for the 21st century.

EXPLORATIONS IN TECHNOLOGY

A Technology Education Program for the Middle Schools in Loudoun County, Virginia

Peter A. Fulcer

DESCRIPTION OF PROJECT

Goals

The technology education program at the middle school is designed to provide the early adolescent with active learning situations and higher-order thinking skill development. The curriculum is formulated from experiences with the resources of technology and the processes of problem solving and creating. Program content is drawn from a comprehensive study of all aspects of technology and is presented to extend student understanding of the development, impact and potential of technology and careers in technology.

The focus of the middle school technology education program is to assist students in exploring and preparing for appropriate educational and technological choices.

This program will have the student of technology education:

1. Develop an awareness of technology.
2. Use the elements of technology for problem solving.
3. Explore construction systems.
4. Explore transportation systems.
5. Explore communication systems.
6. Explore production systems.
7. Make decisions about technology.
8. Use tools, materials, and processes safely and efficiently.

Purpose and Needs

This program is designed to meet the need for students to participate in an active learning situation using higher-order thinking skills. It meets their needs by having the students engage in various modules which were designed with these needs in mind.

Intended Audience

All students in Loudon County participate in Technology Education during their sixth and seventh grades. Sixth grade students are in the lab for twelve weeks on an odd/even day schedule for a total contact time of six weeks. Seventh grade students participate every day during a twelve week rotation. The classes are homogeneously grouped with all ability levels represented. Individuals with special needs are accommodated according to their individual needs.

FEEDER SCHOOLS

Background, Foundation and Theoretical Framework

This program grew out of the desire to move Loudon County into the leading edge of Technology Education by the implementation of an innovative program. This program needed to meet the standards outlined by the Loudon County Public Schools. In addition, the program had to be in compliance with the Tasks/Competencies established by the Technology Education Department of the Virginia Department of Education.

In June, 1988, two technology education teachers were sent to Pittsburg, Kansas to attend a workshop on "The Modular Method of Delivering Technology Education in the Middle School." After participating in this workshop and seeing the program in operation, it was determined that this program could be modified to meet the needs of Loudon County and the State of Virginia.

Between August, 1988 and May, 1989, extensive conversations were held with the staff at Pittsburg Middle School and the program designer, Mike Neden. One prototype instructional module was designed, constructed and equipped by the teachers at Blue Ridge Middle School. In early June, 1989, the decision was made to implement the program at this school. During the summer of 1989, the "shop" was completely renovated to become the new "technology lab." Instructional modules were designed and equipment and materials necessary to support the modules were purchased.

The Blue Ridge Middle School "Synergistic" technology lab with its unique instructional delivery system was completed in November, 1989 and became the first lab of its kind in Virginia and the Mid=Atlantic area. In mid-November, an open house/demonstration was held with approximately eighty-five educators from Virginia, Maryland and Delaware attending.

In September, 1991, the program was expanded to Sterling Middle School. In September, 1992, the program was further expanded to the two remaining Loudoun middle schools, Seneca Ridge and J. Lupton Simpson.

Features: How the Program Operates

The Exploration in Technology program has completely replaced the traditional sixth and seventh grade industrial arts program in the Loudoun middle schools. The synergistic technology lab is an environment unlike a traditional industrial education shop. It is uniquely different - by design of the facility, by the appearance of the room and by all aspects of the curricula. Its appearance speaks volumes to the students, to professional peers, to the administration and to the community it serves.

Workstations are self-contained and include a computer, a notebook which contains the day-to-day instructions, videos, video player with monitor and all necessary module resources. Students are paired on one of eighteen different technology modules of seven days plus one discovery day which is used for group activity. If a demonstration is needed, these demonstrations are video-taped. Students watch these demonstrations and, at the same time, read selected written directions which are provided in the notebook. This system allows for those students who learn best by reading the subject matter and for those who perform best with oral directions.

During the time the students are in a module, they work together on the activities necessary to complete the module. These activities consist of a pretest, videos, research questions, selected readings, computer use, hands-on activities and experiments, record-keeping, journal writing, technical writing reports and a post test. Students use a call light to notify the teacher when they have questions. Each new eight day rotation results in a new module topic and partner.

The following is a list of the eighteen modules:

1. Electricity
2. Electronics
3. Energy/Power/Mechanics
4. Applied Physics
5. Research & Design
6. Graphic Communications
7. Computer Problem Solving
8. Flight Technology
9. Rocketry & Space
10. Transportation
11. Robotics & Automation
12. Desktop Publishing
13. Audio Broadcasting
14. Engineering Bridges
15. Computer Graphics & Animation
16. Computer Applications
17. Nonpowered Flight
18. Photography

In addition, sixth grade students complete an orientation module that incorporates the Virginia Department of Education Computer Literacy Standards of Learning.

Managing student activities is accomplished with the student module records sheet, attendance records sheet, and a personal records sheet all of which are kept in their notebook. Upon entering the lab, students get their notebook and go directly to their module to begin their daily assignment. Students record their own daily attendance in their notebook on the attendance records sheet. Pretests, research questions, test review, journal writing and technical writing reports are kept on the module records sheet in their notebook. All work is checked by the teacher during the seven day rotation.

Grading is done by a point system with students keeping a record of their points on attendance sheets. Students know at all times their point/grade standing.

Staffing and Training

In August, 1990, thirty-seven teachers participated in a one week Explorations in technology implementation workshop held at Blue Ridge Middle School. This workshop was co-sponsored by the Loudoun County Public School system and George Mason University. In addition to the Loudoun teachers, twelve other Virginia school divisions sent teachers to participate in the workshop. This workshop was taught by Mike Neden, the originator of the modular concept of teaching technology education.

In August, 1991, a three-day refresher workshop was conducted. This workshop accomplished its goal by allowing teachers to share ideas, problems and experiences a year after having implemented the program in their respective school divisions. this workshop was taught by the Blue Ridge Middle School Technology Education teachers. Thirty-three teachers from three states participated.

In August, 1992, another three-day refresher workshop was conducted. Twenty-eight teachers from three states and fourteen school divisions participated. This workshop was taught by the Sterling Middle School Technology Education teachers.

Locally, all middle schools have been linked with an electronic bulletin board that is located and maintained in the office of the Director of Vocational Education. Teachers communicate with one another through the use of this medium and exchange ideas daily. Although setup for teachers, technology education students use this bulletin board as part of their telecommunications orientation.

Technical support for teachers is provided by the manufacturers, vendors and central office administration. Computers and other instructional media equipment are repaired by central office support personnel.

Significance of Project Design

The Explorations of Technology program is significant in that it addresses what students will need to know to live in the 21st century. It is not a modification of industrial arts, but a totally new technology education program.

Several aspects of the design of this program distinguish it from others in this field. Among these aspects are curriculum flexibility and cost.

Modules may be purchased from the vendor saving valuable development time. However, the greatest benefit is the opportunity for the teacher to create and/or modify modules which draw upon his or her own specialties. Modules which reflect those technologies common to the local area can be developed. This provides the ability to change the basic program to one which reflects the local industrial/occupational base. Changing the curriculum is as simple as redesigning or modifying some of the modules.

SAMPLE MODULES FROM SYNERGISTIC SYSTEMS, PITTSBURG, KANSAS

Flight Technology

LEARNER OUTCOMES:

- After viewing a videotape on flight and space, the student will comprehend the basic principles of aerodynamics.

- After viewing a Synergistic instructional videotape, the student will design and construct an airplane wing.

- The student will observe and understand the Bernoulli principle by using a Synergistic wing test device to produce and measure lift on an airfoil.

- The student will discover the relationship between wing design and airplane performance by exploring an aircraft design computer software program.

- After viewing a Synergistic instructional videotape, the student will demonstrate knowledge of magnetic directions and compass usage by operating a missile interception computer program.

- The student will explore basic aerodynamic principles by operating a flight simulator.

- The student will increase knowledge of flight technology concepts and terms by reading available module resource material for two specified time segments during the term of the module.

- The student will expand his reading and research skills by using books, software programs and video tapes to complete module research questions.

- The student will experience teamwork, time management principles, cooperative and collaborative learning, self-direction and motivation in work-related situations designed to increase self confidence.

Rocketry & Space

LEARNER OUTCOMES:

- The student will engage in abstract thinking by applying design principles to hands-on activities in the model rocket design and construction process.

- The student will understand the history of U.S. space exploration and the development of rocketry by viewing a videotape.

- The student will comprehend the principles of aerodynamics as they apply to rockets by using a computer software program.

- Using written instructions, the student will build and paint a model rocket.

- The student will observe rocket aerodynamics and flight by launching the rocket and measuring its altitude.

- The student will increase knowledge of rocketry and space concepts and terms by reading available module resource material for two specified time segments during the term of the module.

- The student will expand reading and research skills by using books, software programs and videotapes to complete module research questions.

- The student will experience teamwork, time management principles, cooperative and collaborative learning, self-direction and motivation in work-related situations designed to increase self confidence.

Transportation

LEARNER OUTCOMES:

- The student will realize the importance of transportation by viewing a videotape identifying its crucial role in society.

- The student will understand the transportation strengths and limitations of boats, trains and ships by viewing a videotape.

- The student will understand some of the costs and problems related to the transportation industry by operating a computer simulation program.

- After watching a Synergistic instructional videotape, the student will demonstrate knowledge of a map and its symbols by using an atlas to plan a trip across the country and completing a corresponding worksheet.

- The student will demonstrate knowledge of state locations, capitals and trivia concerning each state by answering selected questions given on a computer software program.

- The student will increase knowledge of transportation concepts and terms by reading available module resource material for two specified time segments during the term of the module.

- The student will expand reading and research skills by using books, software programs and videotapes to complete module research questions.

- The student will experience teamwork, time management principles, cooperative and collaborative learning, self-direction and motivation in work-related situations designed to increase self confidence.

Robotics & Automation

LEARNER OUTCOMES:

- The student will explore the history of robotics using a tutorial computer software program.

- The student will experience and understand the fundamentals of industrial robots by viewing a videotape.

- After viewing a Synergistic instructional videotape, the student will use a computer to program and operate a robotic arm.

- The student will recognize the importance of robotics on the constant change and development of manufacturing and technology in today's society by viewing a videotape.

- The student will increase knowledge of robotic concepts and terms by reading available module resource material for two specified time segments during the term of the module.

- Viewing the image from a closed circuit TV monitor, the student will use joysticks to manipulate a robot arm to perform selected activities.

- The student will expand reading and research skills by using books, software programs and videotapes to complete module research questions.

- The student will experience teamwork, time management principles, cooperative and collaborative learning, self-direction and motivation in work-related situations designed to increase self confidence.

Flight Technology

LEARNER OUTCOMES:

- After viewing a videotape on flight and space, the student will comprehend the basic principles of aerodynamics.

- After viewing a Synergistic instructional videotape, the student will design and construct an airplane wing.

- The student will observe and understand the Bernoulli principle by using a Synergistic wing test device to produce and measure lift on an airfoil.

- The student will discover the relationship between wing design and airplane performance by exploring an aircraft design compute software program.

- After viewing a Synergistic instructional videotape, the student will demonstrate knowledge of magnetic directions and compass usage by operating a missile interception computer program.

- The student will explore basic aerodynamic principles by operating a flight simulator.

- The student will increase knowledge of flight technology concepts and terms by reading available module resource material for two specified time segments during the term of the module.

- The student will expand his reading and research skills by using books, software programs and videotapes to complete module research questions.

- The student will experience teamwork, time management principles, cooperative and collaborative learning, self-direction and motivation in work related situations designed to increase self confidence.

A review of the foregoing programs, projects and activities demonstrates that students in elementary and middle schools are being prepared by creative teachers to become scientifically and technologically literate. Furthermore, they will be well prepared to enter aviation, space, transportation thematic magnet programs.

"I would encourage you to look at your programs and to look at ways of extending aerospace magnet choices into your junior high, middle school and elementary school programs."

Alicia Coro

FEEDER SCHOOLS

SECTION XI - USES OF TECHNOLOGY IN MAGNET SCHOOL PROGRAMS

Aviation and aerospace education, by definition, stem from the influences and uses of technology. The earliest aviation educators had students build model airplanes. Today highly complex airplanes, rockets and a variety of aviation and space vehicles are designed and built by students.

Aviation pioneer Edwin A. Link invented the earliest training device that was the forerunner of later and modern, highly sophisticated flight simulators. Link's first devices to practice learning to fly on the ground were developed between 1927 and 1929. During the 1930's and during World War II thousands of pilots knew his device as the Link trainer. Following World War II many of these devices, including a model designed especially for elementary and high school use, known as the "School Link Trainer," were used throughout the country. In fact, there are some still in use as of 1993.

Edwin A. Link's inventive genius continued from those early days right up to and through the Apollo simulators that his company built to train astronauts.

The use of highly complex simulators continues today. Such devices train those who are just starting to fly as well as providing proficiency and transition training for private, professional, business and airline pilots. Astronauts spend many hours in simulators that duplicate every facet of their flights.

Simulators are just one example of the many uses of technology in aviation education today.

By studying the information describing the various educational models and programs in the earlier sections of this publication, one can readily note the nature and extent of technology utilization starting in the elementary grades.

The latest generation of personal computers including those with modems and CD-ROMs as well as Computer Assisted Design and Drafting (CADD) equipment is more and more common in homes, local libraries and schools.

Robotics and the study of materials and processes including such new substances as composites may be found in many aviation magnet schools.

The use of laser disc technology and other laser applications is becoming commonplace in new technology classrooms.

Hundreds of different topics are regularly studied by use of video tapes in all levels of learning kindergarten through college.

USING A MODERN SIMULATOR IN AN AVIATION MAGNET SCHOOL

Following is a description of why and how current simulator technology can be helpful and cost beneficial in a high school aviation magnet school. This material is taken from a draft report prepared by Edward F. Helmick, a professional flight instructor and Frasca International, Inc., the manufacturer of the simulator being used in the South Mountain High School where it is being tested for improving the efficiency of flight training for high school students in an aviation magnet school. Mr. Lewis Davis, of South Mountain High School, assisted in testing this concept and in writing this report entitled: Mastering Flying Basics in the Simulator or How To Reduce the Cost of the Private Pilot Certificate.

BACKGROUND

Last year the average flight training time for a Private Pilot Certificate in one of the nation's leading high school aerospace magnet school programs exceeded 100 hours. The flight training was provided by a long time FAR Part 141 pilot school in a major metropolitan area. The students that acquired their Private Pilot Certificates through the high school program were all considered to be very bright and capable young people. They were the "top of their class." School officials expressed concern about the high flight training time which exceeded the planned projections and cut into funds available to train additional students.

An inquiry with reputable flight schools in the metropolitan area indicated that the Private Pilot Certificate currently requires 60 hours of dual and solo flight time and costs about $3,500. It is commonly accepted in the flight training industry that it is unrealistic to consider completing the Private Pilot Course in the minimum flight training time specified in the Federal Aviation Regulations. The minimum flight times are 35 hours in an FAR Part 141 course and 40 hours in an FAR Part 61 program.

Many reasons are given why students are not completing the Private Pilot Course in the minimum 35 to 40 flight hours. The most common reason stated is that the minimums were written a long time ago when airplanes and airspace were less complicated. Another reason is air traffic delays around congested airports. For all practical purposes most flight instructors consider the minimum 35 to 40 flight hours unattainable by the average student.

If students were able to complete the Private Pilot Course in the minimum amount of time permitted by Federal Air Regulations it would reduce the cost to approximately $2,200. Reducing the cost of acquiring a Private Pilot Certificate is extremely important to a high school aerospace magnet program that has a limited budget and the need to get as many students through the program as possible. College and university aviation programs as well as ab initio flight training schools would also benefit if the initial training costs could be reduced.

SIMULATOR BASED TRAINING

Flight simulators have become widely accepted in reducing the cost of instrument and advanced pilot training. Every major civilian, military and airline flight training operation uses simulators extensively in their program. Today most airlines do all their transition and recurrent training, type ratings, check rides and proficiency checks in a flight simulator. Furthermore, simulators are not affected by weather and can be reliably scheduled.

The flight simulator has not been widely used or considered for initial private pilot training. However, current state-of-the-art simulators such as the Frasca Model 131 or 141 are full cockpit single engine aircraft with excellent visual displays available that are computerized devices that simulate the real world. These simulators replicate the actual training aircraft in terms of flight control effectiveness, instrumentation and systems and have the proper interrelationships and characteristics. In fact, the Frasca 141 Flight Simulator may be configured at a touch of a button to emulate eight different makes and models of aircraft. These state-of-the-art tools can be used effectively in the private pilot course.

Motivated by the need to reduce private pilot flight training time and training costs, a very detailed simulator-based training syllabus is under development. The concept is that the cockpit orientation, the fundamental principles of flight, radio communication procedures and radio navigation can all be taught to the private pilot student in a high quality flight simulator. If properly used, the current state-of-the-art flight simulator can reduce the time spent in an airplane from 60 or more hours to 40 or 45 hours. In a high school training program attempting to fund

Private Pilot Certificates for 40 students this can result in a savings of $30,000 or more. The flight simulator can also be used as a screening tool to determine which students should be moved to more expensive airplane training.

THE SIMULATOR SYLLABUS

The syllabus that has been developed and is presently in draft form is titled, Mastering Flying Basics in the Simulator. It goes through 20 lessons that gradually enable the student to master the fundamentals of the airplane and air traffic control procedures before a student ever gets in an airplane. Each lesson is titled to identify progress over the previous lessons. The lesson format includes lesson number, title, goal and content, completion standards and quiz questions. A student record folder has also been developed to grade each lesson and record the cumulative results. Mastering Flying Basics in the Simulator is a comprehensive and quality flight training program that will provide the structure necessary to significantly reduce flight time once the students start flying the airplane.

The simulator-based private pilot syllabus has been designed for the student who has completed Private Pilot Ground School and has not started flight lessons in an airplane. An introductory or demonstration flight intended to create enthusiasm for learning to fly should be the only flight experience the student has prior to simulator training. The excitement of being in an aircraft cockpit and learning the knowledge and skills necessary to pilot an airplane and the anticipation of graduating on to real airplanes are motivating factors. The flight simulator training experience is not as exciting as flying an airplane and looking down on the world from above. While airplane flight is thrilling it presents a lot of distractions to learning. It is the absence of flight distractions that adds to the cost effectiveness of simulator-based private pilot training. However, once a students starts flying an airplane his/her interest and enthusiasm for simulator-based training will be reduced.

The syllabus lessons provide for the logical introduction of new material followed by a review lesson. The lessons are designed to provide a positive reinforcement to previously learned knowledge and skills. By following the lesson sequence the student has a sense of progress toward the goal of a Private Pilot Certificate. It is recommended that the student have a simulator lesson 2 to 3 times a week to continually reinforce the learning process. At that rate it will take 7 to 10 weeks to complete the 20 syllabus lessons.

The student effectiveness and efficiency of flight training can be enhanced by having three to five students positioned behind the simulator cockpit as observers. It is common practice in airline and military training to have students observing their peers in the training environment. The concept is that a group of students can gain valuable knowledge without additional cost to the program by observing a fellow student and instructor in a flight simulator lesson. This concept can be further expanded by video camera coverage of the simulator lessons.

The simulator lessons rely heavily on the outstanding visual display available on the simulator. A unique feature of the syllabus is the use of the Horizon Sighting Device to teach the student how to use the natural horizon as an aide to flying the airplane in climbs, turns and descents. The Horizon Sighting Device is essentially a vertically adjustable gun sight that sets on top of the cockpit glare shield. This device teaches the student how to keep track of the nose attitude of the airplane in respect to the natural horizon depicted in the visual display.

Throughout the syllabus, lesson emphasis is given to the student looking out of the airplane. Collision avoidance precautions are stressed. A lot of consideration has been given to the issue of transitioning from 20 hours of simulator-based training to flying a real airplane. The syllabus is designed to prepare students for the real world environment in real airplanes.

BENEFITS OF THE SYLLABUS

Twenty hours invested in a structured, high quality, simulator-based pre-airplane private pilot course will enable the student to have the knowledge and skills to progress through an airplane flight training syllabus in a minimum amount of time. It will still take the student approximately 65 hours of training time to acquire the Private Pilot Certificate but 20 hours of that time will be in a relatively inexpensive and learning-efficient flight simulator. The student will be so well prepared that he/she will excel on the flight stage checks and final practical flight exam.

Under Federal Aviation Regulations Part 141 Pilot School Private Pilot Certification Course requirements the use of a Frasca 131 or 141 flight simulator with the visual system may reduce the total flight time requirements to 30 hours. This is not an unreasonable goal considering the thoroughness and level of training provided in the simulator based pre-airplane training syllabus.

The cost savings of using a simulator-based instruction prior to putting the student in an airplane is significant. As previously mentioned, in a high school training program attempting to fund Private Pilot Certificates for 40 students this can result in a savings of $30,000 or more. The simulator can also be used as a screening tool to determine which students should be advanced to more expensive airplane training. By reducing training costs the incentive of flight training can be made available to a larger number of students.

While space does not permit giving details of all of the lessons here, the twenty lessons are listed below:

LESSON INVENTORY

Lesson Number	Lesson Title
1	Introduction to the Cockpit
2	Introduction to Ground Operations
3	Review Ground Operations
4	Introduction to Flight Operations
5	Review Fundamental Flight Operations
6	Introduction to Advanced Fundamental Flight Operations
7	Advanced Fundamental Flight Operations
8	Review Advanced Fundamental Flight Operations
9	Introducing Unusual Flight Situations
10	Review Unusual Flight Situations
11	Introduce Airport Traffic Pattern Procedures
12	Review Airport Traffic Pattern Procedures
13	Introduction to Abnormal Situations In Flight
14	Review Abnormal Situations In Flight
15	Advanced Radio and Flight Procedures
16	Review Advanced Radio and Flight Procedures
17	Introduction to ADF Radio Navigation
18	Introduction to VOR Radio Navigation
19	Review Radio Navigation Procedures
20	Final Review

To show how each lesson is presented, following are several of the lessons as detailed in the syllabus:

Lesson #1	Introduction to the Cockpit
Lesson Goal:	During this lesson the student is introduced to the training airplane cockpit using the Frasca International Flight Simulator Model 131 or 141 as an example. The student will learn about the aircraft instruments and controls. The concept of using the aircraft checklist will also be introduced.

Lesson Content

- Flight controls
- Flight instruments
- Engine instruments
- Avionics
- Introduce use of checklist
- Introduce the concept of integrating visual and instrument references

Completion Standards

The student will have knowledge of the training aircraft instrumentation and avionics. Additionally, the student will become familiar with the layout of the aircraft cockpit and the aircraft checklist. Introduction and familiarization is the goal.

Instructor Notes

- Provide detailed discussion on the location and function of each cockpit item.
- Be sure and discuss the markings on the airspeed indicator.
- Discuss with the student that pilots flying in visual meteorological conditions fly by outside visual references but back up those references with instrument reading.
- Use the aircraft checklist as a guide to orienting the student to the cockpit.
- Near the end of the orientation session, the simulator may be turned on and put in flight to demonstrate the relationship between the flight and power controls and the visual display and aircraft instrumentation.

Quiz Questions

1. What are the three axes of flight?
2. What instruments are in the flight instrument group?
3. What are avionics?
4. Why is an aircraft checklist important?
5. How does the pilot control the attitude of the airplane?
6. What is the purpose of the elevator trim wheel?
7. What positions are on the fuel selector?
8. What is the OAT and where is it located?

Lesson #2	Introduction to Ground Operations
Lesson Goal:	The student will review the cockpit layout and will become familiar with the aircraft checklist and how to start the engine. The student will be introduced to radio and taxi procedures. Additionally the student will conduct the pre-take-off checklist items.

Lesson Content

- Review cockpit layout.
- Use checklist to start aircraft.
- Radio communication procedures.
- Taxi procedures.
- Pre-take-off checklist.

Completion Standards

The student will know how to use the checklist to start the aircraft. The student will also learn how to use the aircraft radios and have a knowledge of the aircraft systems and the necessity of checking their operations before flight. At the completion of this lesson the student will be familiar with the aircraft systems and how they are used to maneuver the airplane on the ground.

Instructor Notes

- The student should listen to and copy down on paper an instructor simulated ATIS broadcast using the standard format outlines below:

  ATIS Code
  Temperature
  Altimeter Setting
  Ceiling
  Wind
  Remarks
  Visibility
  Runway

- The instructor, in addition to providing a simulated ATIS broadcast, should also play the role of Ground Controller for student radio communications.
- Do not forget the brake check when commencing taxi.
- Practice taxi procedures by making 90-degree turns using rudder pedals and toe brakes as necessary.
- Run through the complete pre-take-off checklist and explain to the student the significance of each item and how it is being checked.

Quiz Questions

1. What is ATIS?
2. What is the purpose of ground control?
3. What is the purpose of carburetor heat?
4. What is the mixture control?
5. How many spark plugs does our basic training aircraft have?
6. What are magnetos?
7. What is the suction gauge for?
8. What is the maximum allowable RPM drop during magneto check on run-up?

Lesson #4	Introduction to Flight Operations
Lesson Goal:	The student will learn how to take the aircraft off the ground and maneuver the airplane in the air. The student will also learn collision avoidance precautions.

Lesson Content

- Review aircraft start-up.
- Review communications procedures.
- Complete pre-take-off check.
- Normal take-off and climb-out.
- Collision avoidance precautions.

- Straight and level flight.
- Power setting and mixture control.
- Climbs.
- Descents.
- Medium banked turns.
- Introduce climb and cruise checklist.
- Introduce shut-down checklist.

Completion Standards

The student will be able to make a simulated take-off with the instructor's assistance. Additionally, the student should be familiar with control usage for straight and level flight, climbs, descents and medium banked turns maintaining an altitude within 300 feet of that assigned by the instructor. Collision avoidance procedures should be performed by the student following the instructor's guidance.

Instructor Notes

- Discuss factors affecting the take-off run and climb-out.
- Use the Horizon Sighting Device to teach the student how to use the natural horizon as an aide to flying the airplane in climbs, turns and descents.
- Teach the student to cross check the outside visual references with the flight instrument indications.
- Discuss collision avoidance procedures such as:
    1. Lowering the nose of the aircraft every couple of minutes to enable the pilot to see over the engine cowling. (At a rate of climb of 500 feet per minute check over the nose every 1,000 feet.)
    2. Shallow turns on the climb-out can also be used to scan for traffic.
    3. Raise the wing in the direction of the turn and look for traffic before turning the aircraft.
    4. Bank the wings from side to side to enable the aircraft to be seen more easily.
    5. Discuss blind spots in high and low wing aircraft.
    6. Discuss how to focus the eyes to avoid empty field myopia.
    7. Discuss high collision risk times such as base to final in the traffic pattern and over reporting points.

Quiz Questions

1. What factors affect normal take-off?
2. Describe how to make a level turn in flight?
3. Describe how to scan for aircraft traffic.
4. Can flaps be used for take-off and if so, is there a limit

on the amount of the flap setting that can be used?

5. When operating in a tower environment who is primarily responsible for collision avoidance?
6. What are the three things the control tower can tell you when you are ready for take-off?
7. What is a medium bank turn?
8. How do you make an airplane descend?

Lesson #9 Introducing Unusual Flight Situations

Lesson Goal: Since the student has now learned to control the airplane in flight, he will now be taught how to maintain control of the airplane when the pilot has flown into a situation out of the normal flight regime. Such situations include flying the airplane into an aerodynamic stall situation, flying into the clouds and losing visual references outside the airplane. This lesson will expand both airmanship skills and confidence.

Lesson Content

- Review radio communication procedures.
- Review straight and level flight, turns and descents.
- Review constant altitude turns.
- Review turns to a heading.
- Introduce power-off and power-on stalls.
- Introduce straight and level flight by reference to the flight instruments only.
- Introduce standard rate climbs and descents by reference to the flight instruments only.
- Introduce constant altitude airspeed changes by reference to the flight instruments only.

Completion Standards

The student should learn procedurally how to recover from an aerodynamic stall situation. The student should demonstrate increased skill in instrument scan and interpretation during instrument flight conditions.

Instructor Notes

- Discuss with the student how pilots inadvertently fly the airplane into an aerodynamic stall. This lesson introduces how normal flight can be recovered with minimum altitude loss. Also discuss pilots who can legally fly only VFR but who fly into the clouds and how they must be able to scan and interpret the flight instruments in order to control the airplane and return to visual meteorological conditions.
- Begin the lesson with the simulator positioned in flight.
- Use the flight hold function frequently to discuss problem areas or newly introduced training exercises.
- Teach the student proper instrument scanning.
- Discuss radio procedures that might be used by Air Traffic Control (ATC) if a pilot flying VFR enters clouds.
- Reiterate that the purpose of this lesson is confidence-building and survival should a VFR pilot fly into the clouds.
- Discuss the need to check the heading indicator and align it with the magneto compass every fifteen minutes.

Quiz Questions

1. What is the difference between a power-on and a power-off stall, other than the power setting?
2. List the six basic flight instruments in the order in which they are found on the instrument panel.
3. Explain the pitot-static instruments.
4. Explain how the gyro instruments work.
5. What are the instruments that provide information about aircraft power? One is in the flight instrument group and the other is not.
6. If the pitot tube becomes clogged what instrument or instruments will be affected?

Lesson #14	Review Abnormal Situations In Flight
Lesson Goal:	The student will learn to recognize and deal with system and equipment malfunctions in simulated flight situations.

Lesson Content

- Review abnormalities in the pitot-static system.
- Review vacuum system failure.
- Review electrical system abnormalities.
- Review engine abnormalities such as low oil pressure, fluctuating oil pressure, high oil pressure, high oil temperature, high cylinder head temperature, rough running engine and total engine failure.
- Review communication radio transmitter and receiver abnormalities.

Completion Standards

The student will recognize system and equipment malfunctions and take the appropriate action in order to maintain the safest flight operation possible.

Instructor Notes

- Continue to develop and reinforce proper radio communication procedures by role playing.
- Continue to reinforce proper checklist use.
- Begin the lesson with the simulator positioned in flight.
- Randomly simulate aircraft system and equipment malfunctions.
- Recognition and appropriate action is the goal for student performance.

Quiz Questions

1. Discuss the procedure to be used in the event of partial or complete engine failure.
2. Explain and define the approximate glide ratio for the training aircraft.
3. What conditions must be present for carburetor ice to form?
4. Why does power loss occur when you apply carburetor heat?
5. Excessive cylinder head and engine oil temperature can be caused by what?
6. What is the first indication of carburetor icing?

Lesson #19 Review Radio Navigation Procedures

Lesson Goal: The student will develop proficiency in using radio aids for aircraft navigation.

Lesson Content

- Review control of the aircraft by reference to the flight instruments only.
- Review collision avoidance precautions.
- Review navigation with the ADF equipment.
- Review navigation with VOR equipment.
- Review flight on Federal Airways.
- Review air traffic control communications.
- Introduce control of the aircraft and navigation by reference to the instruments.
- Review unusual attitude recoveries by reference to the flight instruments.

Completion Standards

The student should understand radio navigation techniques and be able to identify his position by using one or more radio aids. Additionally, the student should be able to track a non-directional beacon (NDB)and home to a VOR with very little instructor assistance.

Instructor Notes

- Begin the lesson with the simulator positioned in flight.
- Have the student practice a few climbs, turns and descents to an assigned heading, altitude and airspeed by reference to the flight instruments only. After this warm-up exercise go to a visual meteorological condition display to review radio navigation.
- The object of this lesson is to practice radio navigation.
- Expect the student to track NDB with very little assistance and home with only a little coaching.
- Expect VOR tracking and radial intercepts with a little assistance.
- Program the simulator for instrument meteorological conditions and have the student fly the airplane with instrument references only, combining for the first time aircraft control and navigation.

- Before the end of the lesson go through three exercises with unusual attitude recovery by reference to the flight instruments only.
- Discuss the collision avoidance precautions

Quiz Questions

1. Are VOR radials aligned to magnetic or true north?
2. How do you know if an NDB or VOR station is undergoing maintenance?
3. How wide is a Federal Airway?
4. Explain how to determine station passage with ADF.
5. Explain how to determine station passage with VOR.
6. Explain position identification with cross radials or bearings.

It is clear that the use of simulators can enhance learning, safety and flight training efficiencies and economies. What is remarkable in the context of aviation magnet high school programs is that more and more school systems are buying and using high technology flight simulators.

LOOKING TO FUTURE AVIATION EDUCATION TECHNOLOGY

Within a few years it is probable that aviation magnet high schools can be linked to a new system of what is referred to as distance education. Basically this system will permit a central location to transmit and receive communications from classrooms many miles away. This technology is now a reality at the college level as a result of two grants in the total amount of seven million dollars by the FAA to the Airway Science Distance Evaluation Center in the Center for Aerospace Sciences of the University of North Dakota. The system, as being operated by the University of North Dakota, uses three technologies: videotape, computer-based instruction and satellite technology.

In a paper delivered at a national conference in January of 1993, Dr. Scott J. Bergstrom, of the University of North Dakota, described the increased use of distance education in the private sector as well as in higher education. His paper entitled, "Distance Education for the Airway Sciences: Promises and Challenges" described the new program. According to Dr. Bergstrom three functions have been incorporated into the mission statement of the University of North Dakota Airway Science Network:

USES OF TECHNOLOGY

> "to teach, motivate and inform a nationwide audience of aerospace students, scholars and professionals through the use of advanced educational delivery systems."

While the University of North Dakota program is designed for other college and university students today, there is every reason to believe that similar delivery systems will indeed be available for high school and elementary students tomorrow.

Without question, today, and in the future, technology utilization is - and will continue to be - a key component in aviation magnet educational programs.

SECTION XII - PREPARING FOR AVIATION - AEROSPACE - TRANSPORTATION CAREERS

FAA has been a national leader in responding to the need for providing students, teachers, guidance counselors and others with a wide range of aviation and related transportation career materials.

Such materials describe: kinds of job opportunities, preparation and study needed, prospects for employment, working conditions and characteristics employers are looking for in new employees.

In recent years it has become apparent that anyone entering aviation, aerospace or any of the other modes of transportation will probably have at least seven changes of career or job emphasis over a normal working life. Thus, in planning for a career, it is necessary to look ahead at new technologies, scientific advances and manufacturing processes to discover what potential employers look for in recruiting workers.

When one examines the total system of transportation, it becomes clear that regardless of which part of transportation is considered, the various modes of transportation all have common functions that employees perform. This is especially true as one moves up the career ladder.

Today, there are important functions performed in common within every mode of transportation. Considering aviation, railroad, subway (mass transit), highway (trucking, bus), waterway (shipping, barges), pipeline and space (shuttle) modes of transportation it is interesting to examine those areas all have in common.

A new term - intermodal transportation - has emerged in recent years to describe the relationship between various forms or modes of transportation.

In planning educational programs to prepare for leadership roles in aviation, aerospace or transportation it is worth noting that the various modes of transportation have more functions in common than differences. Following is a list of just a few areas of potential study and learning if one is to prepare for the world of work in any mode of transportation:

- Data Management
- Distribution Services
- Environmental Concerns
- Maintenance Services
- Marketing Services
- Management Services
- Passenger/Cargo Services
- Regulatory Rules and Standards
- Safety Procedures and Standards
- Systems Planning
- Consumer/Customer Relations
- Communications
- Foreign Languages
- Human Relations

It should be understood that any one of the above fourteen functions can be a total area of study. However, it must also be realized that modern transportation employers need and encourage employees to be as knowledgeable as possible about all of the elements that contribute to making a safe, economical, efficient total transportation system.

ARE THERE JOB OPPORTUNITIES FOR AVIATION MAGNET SCHOOL GRADUATES?

Students, parents, teachers, administrators quite properly ask the question: If one studies areas such as described in this publication will he or she find employment?

There are some facts and trends that help one understand the answer to this fair question. Currently in the United States, transportation accounts for twenty percent (20%) of our total economy. Within transportation, aviation and aerospace represent a very large part of this total. Also, as noted above, anyone who is well prepared for an aviation-aerospace-transportation career can readily transfer to another form or segment of transportation.

An example of the job/career transferability of a graduate of an aviation magnet high school program is demonstrated in the following account.

John or Jane Doe graduates from the local aviation magnet school program which features an FAR Part 147 Airframe and Powerplant Maintenance Technician (AMT) program. Jobs in the local market in aviation are not readily available. However, local car dealerships and tractor and agricultural equipment businesses are always looking for graduates of this program. Why? Because these students have demonstrated by written and practical examinations their ability to:

- read, understand and apply federal rules, regulations and standards in their maintenance work.
- use expensive tools and equipment properly.
- trouble-shoot and repair systems such as electrical, hydraulic, refrigeration or air conditioning.
- accept responsibility for signing that repair work has been done competently to make the equipment repaired safe.
- use all kinds of processes ranging from welding to riveting to working with new composite materials.

These are just some of the highly sought skills that employers from all segments of the economy are looking for in hiring.

Using another example, what can a potential employer learn about John or Jane Doe who just graduated from an aviation magnet school and has attained a private pilot license?

This student, in the process of attaining this rating, will have demonstrated a variety of important things including:

- passing an FAA medical examination that indicates vision, cardio-vascular and other functions are satisfactory and that the applicant is drug free.
- demonstrating an ability to read, understand and pass a written and practical test that includes flying an expensive, complex airplane solo.
- showing responsibility for the care and use of a machine.
- possessing the self-discipline of study and flight operations.
- following complex rules and instructions.

In short, these are the kinds of attributes that many employers try to find in people they hire - regardless of the job to be done.

WHAT IS THE OUTLOOK FOR AVIATION CAREERS NOW AND IN THE FUTURE?

The FAA, as an employer, encouraged the creation of the Airway Science program to help supply needed personnel for government and industry. Graduates of these programs are regularly recruited even during times when some industries are reducing programs and employees.

In terms of the future for pilots and Aviation Maintenance Technicians (AMTs), even during the current period of reductions by some airlines and other aviation employers, the future looks bright for young people studying today.

Congress has established a commission to study pilot and maintenance technician manpower needs of the nation. While the work of this group is not yet completed, currently available (1993) information shows a number of facts and trends.

Civil Pilots: In looking at the total uses of civil pilots in the economy of the nation it must be realized that these include: airlines, business/corporate, air taxi, agricultural, flight instructor and other pilots such as small cargo and specialized aerial services such as pipeline patrol, wildlife and forestry management and photographic mapping. As of 1990 there were 134,856 professional pilots in these occupations. By the year 2003 it is projected that there will be a need for nearly 40,000 more. This increase is anticipated based on retirements and growth in businesses requiring such professionals.

Aviation Maintenance Technicians: AMTs are defined as any person who works to maintain an aircraft, aerospace vehicle, or component thereof in an airworthy condition. This category of skilled employee is one that is in great demand today and will be for the foreseeable future. According to the Pilot and Aviation Maintenance Technician Shortage Blue Ribbon Panel:

> "Numerous sources predict that there will be a need for 100,000 - 120,000 AMTs by the year 2000. This number is based on the current number of technicians combined with the new positions related to new aircraft and increased attention to continuing airworthiness of older aircraft. The shortage will range from 65,000 to as many as 85,000 new AMTs needed by the year 2000."

There should be no doubt in the mind of anyone as to the future outlook for employment for young people preparing for a career as a pilot or maintenance technician. Other jobs in aviation, aerospace and transportation will continue to need well prepared young people as well.

AVIATION EDUCATION AND INTERMODAL TRANSPORTATION

As aviation, aerospace and all modes of transportation grow more highly complex, they manifest more and more functions in common. Thus, one can expect more educational planners to take intermodal transportation into consideration in developing programs to educate citizens and workers for the twenty-first century.

The Atlanta, Georgia Walter F. George High School Transportation Careers' Magnet School described in Section IX is an example of this trend.

On the college level, a recent development along this line is worth noting. Dowling College on Long Island, New York has had a fine aviation program for many years and is one of the fifty three colleges offering FAA Airway Science programs. Their faculty, students, advisors, trustees and administrators recently decided that their aviation experience should be expanded to include preparing young people to qualify for the growing intermodal trends in industry and government. This new educational approach is readily noted in the following mission statement:

DOWLING COLLEGE
NATIONAL AVIATION AND TRANSPORTATION CENTER
Mission Statement

Dowling College is committed to establish the National Aviation and Transportation Center (NAT Center) on 105.53 acres at Brookhaven Calabro Airport, Long Island, New York. It will be a multidisciplinary, intermodal facility, to educate individuals in all facets of intermodal transportation. By definition, intermodal transportation encompasses the safe, timely, efficient, economical movement of people, goods, resources and integrated services worldwide. Process and plans are applied to assure that needs are met in environmentally sound ways that are in the best interest of the global community. It requires multidimensional thinking which defines all movement, by any mode, in its relationship with all others to assure that the best and most acceptable method of delivery is used. It endorses the interrelated nature of all modes of transportation and strives to apply them regionally, nationally and globally. Based upon this definition, this new and innovative facility, will become the only comprehensive campus where, through academic offerings and continuing education programs, people will be educated to address the intermodal transportation needs of the region, nation and the world.

INTERMODAL TRANSPORTATION AND THE FUTURE

The United States Congress, in 1991, saw the need for better total transportation system planning and passed the Intermodal Surface Transportation Efficiency Act (ISTEA). This existing law affects all modes of transportation and has special relevance for aviation.

Mr. Frank W. Pentti, Deputy Director, Office of Intermodal Transportation in speaking to the New York Chapter of the Transportation Research Board on November 5, 1992 stated:

> "The ISTEA legislation stresses two new words - 'intermodal' and 'efficiency.' ISTEA represents the most striking approach to thinking about transportation systems since the creation of the Interstate Highway System."

He went on to say:

> "No longer can planning be done for one mode of transportation in isolation from others as it has been done too often in the past."

Finally, Mr. Pentti described the clear national interest we all must have in understanding the role of intermodal planning in achieving national goals:

> "Our transportation system is only as strong as its weakest link. Unfortunately that weakest link is all too often at those intermodal points where we need to move freight efficiently from truck to

> plane, or from ship to train. As a country, if we succeed in strengthening these key linkages between modes, we will succeed in maintaining our competitive edge in providing a flexible, responsive and market-oriented transportation system. If we fail to address intermodal concerns adequately, transportation bottlenecks with significant economic ramifications will emerge."

If intermodalism is to be understood by the public and put into practice by workers in transportation, educators must plan to include its concepts in curricular offerings preparing young people for twenty-first century transportation careers.

APTITUDES AND AVIATION/AEROSPACE CAREERS

Any student who is considering preparing for a career in the broad field encompassed by the term aerospace should become familiar with the aptitudes that have been found to be related to success in various aerospace age careers. The following chart, adapted from the Civil Air Patrol text Aerospace: The Challenge, will help anyone see the relationships between aptitudes, related job functions and selected careers.

APTITUDES AND AEROSPACE CAREERS

Aptitudes	Related Vocational Activities	Selected Aerospace Age Careers
Mechanical	Equipment Development Aircraft Maintenance Machinery Repair	Astromechanical Engineer Astronautical Engineer Production Technician Powerplant Mechanic Instrument Repairman
Verbal	Speaking and Writing Giving Instructions Persuasive Activities	Flight Instructor Public Relations Director Air Traffic Controller Military Information Specialist Airline Sales Representative
Scientific	Research and Invention Experimentation Scientific Investigation	Aeronautical Engineer Physical Chemist Research Metallurgist Astrophysicist Aeromedical Lab Technician
Manipulative	Equipment Operation Machinery Control Instrument Supervision	Aircraft Pilot Flight Engineer Radar Specialist Machine Tool Operator Production Expediter

Numerical	Mathematical Calculations Arithmetic Reasoning Computational Activities	Data Processing Engineer Aircraft Navigator Research Mathematician Industrial Accountant Airline Statistician
Administrative	Managerial Activities Supervisory Responsibility Secretarial Duties	Research Project Director Management Engineer Airport Operator Military Administrative Officer Stenographer
Social	Service, Advice and Assistance to Individuals and Groups	Aviation Psychologist Personnel Manager Flight Nurse Training Director
Artistic	Self-Expression Through Design, Drawing and Other Creative Skills	Design Engineer Airline Architect Photographic Technician Technical Illustrator Scale Model Builder

Magnet school programs described in this publication do work. Students learn and earn, they are employable and they are paid well when they are prepared. If students take advantage of these programs in all levels of education, the work force of the future will undoubtedly be well prepared for the twenty-first century.

One of the provisions of the ISTEA legislation, referred to above, is for the National Highway Traffic Safety Administration (NHTSA) of the U.S. Department of Transportation (DOT) to do research and encourage product development by industry in the area of "... Intelligent Vehicle Highway Systems (IVHS)." In December of 1992 NHTSA submitted an IVHS plan to Congress that calls for using technologies that are in common use in aviation - microelectronics, processors, communications and sensors. All of these categories of technology are a part of the studies of young people in high school aviation magnet schools and in many Airway Science college programs.

It is obvious that our federal transportation authorities plan to design automated highways and vehicles. Magnet school students studying these technologies today will be among the leaders designing and building the highways and vehicles of tomorrow. The "Intelligent Vehicle Highway System" (IVHS) of tomorrow will most certainly make use of the intelligent graduates of aviation - space - transportation magnet schools of today.

"Aerospace magnets offer a superb opportunity to attract students who are interested in pursuing careers and education in mathematics, science and technology. These magnets help prepare students for today's technologically complex workplace and for higher education. In this regard, your aerospace magnets have a highly important role to play in increasing the numbers of minority and female students who are well prepared to successfully compete in rigorous undergraduate and graduate level mathematics, science and engineering programs in our colleges and universities."

Alicia Coro

SECTION XIII - STEPS IN PLANNING AND DEVELOPING AN EFFECTIVE MAGNET SCHOOL PROGRAM

This section is based on two main sources. The first is taken from the September, 1983: Survey of MAGNET Schools Analyzing a Model for Quality Integrated Education (see bibliography).

The second part of the section describes the approach used in 1992 in planning the Castlemont Aviation High School program in Oakland, California. Included are excerpts of the Castlemont program report prepared by Ms. Maxine Smith (see bibliography).

It is suggested that anyone thinking of planning an aviation or related magnet educational program, first review the various examples of existing programs described in varying detail earlier.

While the information about planning an effective magnet school program based on the significant 1983 survey refers to federally funded programs that are designed for desegregation and related objectives, the report has data and suggestions for any school system regardless of funding. In short, good planning and related practices have universal application.

The following material is excerpted from the September, 1983 Survey of Magnet Schools referred to above.

KEY STEPS IN PLANNING AND DEVELOPING AN EFFECTIVE MAGNET SCHOOL PROGRAM IN AN URBAN SCHOOL DISTRICT

The findings from the national study of magnet schools show that magnet schools can be effective in improving education quality in urban school districts and assisting with school desegregation. However, magnet schools across the country vary widely in quality and effectiveness. Many districts currently operating magnet schools and programs can make improvements by considering the elements of quality programs we have identified. Urban district administrators, school board members, parents, principals and teachers who are planning magnet schools can benefit by the analysis of factors at the district and school levels that are important in producing effective magnets.

In planning magnet program development, education decision-makers should keep in mind the **ideal** design for magnet schools as indicated by our study findings:

a) Districtwide access for students on the basis of voluntary preference;
b) A curricular theme that is definite, appealing and distinctive;
c) A principal and a staff composed and disposed to deliver on that theme, as advertised;
d) Instruction that is reviewed by the district for its rigor and fairness - accountability;
e) A facility and site chosen for their racial, ethnic and socio-economic neutrality;
f) Good transportation and school security services;
g) Student and staff composition that closely reflect the racial and ethnic composition of the system.
h) A method of checks and balances that will prevent segregation or service deprivation in non-magnet schools;
i) Startup funds for facilitating early success in implementation.

The elements of program planning, design and development that are necessary to produce effective magnet school programs are outlined in 10 steps and a series of decision points that are critical to fulfilling each step.

1. Identify District Education Problem(s) to be Addressed.

    A. Assess the extent and breadth of interest in magnet schools and themes within the community; seek broad and varied input into consideration of problems that can be addressed and what problems might be raised by magnets.

    B. Evaluate the status of desegregation in the district and how magnet schools could best assist with improvement of racial/ethnic composition and response to desegregation.

    C. Determine public, parent and district concerns with the quality of education and approaches that would make improvements.

    D. Consider capacity of buildings and degree of under-utilization, quality of facilities.

2. Establish the District's Desegregation and Education Objectives for the Program.

    A. Evaluate how magnets will fit goals for desegregation: districtwide effects and school-level goals, assistance with a specific area/schools or impact on total district.

B. Set the objectives for improving education quality: increase the available curriculum options, improve the core academic curriculum, offer greater career preparation, or a combination of the three.

C. Establish methods of gaining broad student access and opportunity to volunteer for magnets.

D. Determine how magnet programs can help balance student enrollment between schools and areas; improve efficiency of facilities.

3. Design the Overall Strategy for Meeting Desegregation and Education Objectives.

A. Consider appropriateness of a broad strategy that encompasses a large number of schools and areas of the city versus a limited strategy that focuses on a few quality magnet schools; extent to which the strategy includes program expansion based on successful results.

B. Determine the appropriate locations, types of programs and themes based on interests/needs, objectives and basic strategy; balance the strategy variables to create maximum positive response across the total community and ensure racial/ethnic student balance and district desegregation progress.

C. Select themes that are definite, distinctive and appealing.

D. Assign responsibilities for district program coordination and determine system for management of implementation and operation in schools.

E. Ensure participation by school-level staff and community in strategy-development process.

F. Obtain the consensus of district leadership on strategy: school board, superintendent and top administrators.

4. Appoint Strong Leaders for Program Implementation.

A. Select a central program coordinator at the district level with access to decision-makers, strong management and innovative capacity and ability to work closely with principals and teachers.

B. Identify criteria for effective magnet school principals, including leadership qualities, resourcefulness, experience with the theme, contacts with the community and curriculum interests.

C. Determine qualities of candidates, including existing principals and new applicants and then hire most qualified on magnet criteria.

5. Identify and Develop Program Resources.

A. Assess the number and types of staff required for the proposed magnet themes and designs.

B. Plan what community support and resources will be sought: business and industry, universities, cultural and educational organizations and parent groups.

C. Assess the quality and appropriateness of buildings and facilities. If necessary, close the school to make changes and upgrade its remodeling to create new perception in the community.

D. Compute the amount of extra funds necessary for program startup and operation, seek sources of funding for the program - preferably outside the regular district tax revenues.

6. Design Individual School Programs and Select Staff.

A. Design a school-level program that matches the theme and purpose - including curriculum, staff qualities, student enrollment plan, unique activities and teaching methods, community resources.

B. Plan the use of available space and facilities for the program design.

C. Hire teachers and other staff for the magnet program using criteria for evaluation based on magnet theme, particularly special training and skills, commitment to the magnet concept, ability to work closely with teachers and students, capacity for innovation and flexibility.

D. Develop staff participation in the program design process in coordination with district-level curriculum staff.

   E. Seek participation of parents, community organizations, business and higher education institutions in school-level planning and design.

7. Write and Develop Curriculum.

   A. Integrate the theme into the courses, activities and elements of the program design, maintain theme distinctiveness.

   B. Establish relationship of the magnet curriculum to the districtwide curriculum for the grade level.

   C. Encourage and facilitate innovation in curriculum and teaching methods, include multi-cultural, multi-ethnic learning.

   D. Use curriculum writing as an opportunity for team building of magnet staff. Identify and develop unique elements of the program.

   E. Incorporate community specialists through part-time or volunteer instruction.

   F. Develop methods of integrating experiential education.

8. Program and School Publicity/Recruiting.

   A. Design the marketing and recruiting approach, e.g., districtwide versus focused on specific areas or population groups that are less likely to respond.

   B. Incorporate methods and techniques that will help maintain equal access to magnet schools.

   C. Integrate parent and community resources in publicity and recruiting, develop media campaign.

   D. Coordinate recruiting efforts by individual magnet schools to reduce negative responses from other schools.

   E. Build methods of self-recruiting through students and parents and program reputation.

9. Motivating and Organizing Students and Staff.

   A. Organize magnet classes and activities that are interest-based and racially heterogeneous, not tracked or racially stratified.

B. Build positive identity of the magnet school among students and staff and within the community.

C. Establish high expectations and student attitudes promoting educational objectives.

D. Develop clear rules and procedures for magnet operations.

10. Maintain Support for Program.

A. Stimulate necessary funding and program resources to maintain unique and special magnet characteristics.

B. Expand and reinforce private sector, university, community organization and parent involvement.

C. Develop and disseminate publicity on magnet results and outcomes.

D. Identify potential for innovative features/themes of magnets to be used and shared with other schools.

E. Develop a plan for spinoffs of magnet successes and expansion of the concept based on parent, student, and community interests.

After many months of analysis of the study data and survey results, we conclude that not only can magnet schools be effective vehicles for providing quality education but, if properly utilized, can facilitate desegregation in a manner not disruptive to the community.

IMPROVING QUALITY OF EDUCATION:

1. Magnet schools can and do provide high quality education in urban school districts. One-third of the magnet schools in our study have high education quality as measured by ratings of instructional quality, curriculum, student-teacher interaction, student learning opportunities and use of resources.

- High education quality in a magnet school is strongly related to three factors:

  1) an innovative, entrepreneurial principal;
  2) a high degree of coherence of the theme, curriculum, teaching methods and staff to form a strong program identity; and

3) special treatment by district administration with rules, conventions and procedures.

Magnet school education quality is not related to its size, type of theme or method of organization (total school versus part-school program).

- Across the total sample of magnet schools and districts in our study, there was wide variation in education quality, which indicates differences in district objectives and commitment to magnet programs.

Most magnet schools do offer educational diversity and choice of type of education to students and parents in urban school districts.

- The primary district-level factors in high education quality with magnets are policy commitment, a district program strategy and implementation plan that emphasizes improving education quality and administrative flexibility with the schools.

Districts that have educationally effective magnets give their magnet schools flexibility and some special treatment in administrative procedures, staffing and use of resources.

In districts that take a low-priority approach to magnet schools and view them mainly as a means of reallocation of students and/or giving new labels to old programs, there is little indication of quality improvements. Approximately 25 percent of districts take this low priority approach with little quality results.

- In magnet schools with high education quality, the principal, teachers and other staff are selected according to criteria that are consistent with the school theme and objectives.

Magnet school teachers in effective schools typically have high levels of commitment to the magnet concept and high interest in the theme-based instruction.

Staff are selected through a process that departs, to some degree, from district standard procedures, e.g., specifying need for certain experience and training, commitment to the concept, capacity for spending extra time and effort with students. Generally, the magnet principal has a greater role in selection than in other schools.

PLANNING

Many of the educationally effective magnet schools make use of specialists from the community to provide unique assistance with instruction and resources for learning.

2. Quality education in magnet schools does not require highly selective methods of student admission.

- Magnet schools with high quality education serve average as well as high ability students.

  The degree of selectivity in admitting students is not related to our ratings of the quality of education in instruction, curriculum, learning opportunities, etc.

  Most magnet schools do not select only the brightest students. Of the 45 schools in the study sample, only 14 use achievement test scores, grade point averages or other highly selective methods of admitting students. The magnets that use highly selective admitting standards are generally in those districts where parents were supportive of this type of magnet.

  Voluntary enrollment does improve the quality of education in magnet schools by self-selecting more motivated students. In most magnets, students with academic or behavioral problems are screened out.

- Eighty (80) percent of the 32 magnet schools in our study that reported achievement test scores have higher average scores than their district averages. Differences are partly due to methods of selecting students for magnet schools.

  In over 40 percent of the schools, students' average reading and mathematics achievement scores were over ten points above district averages.

  Twenty (20) percent of the magnets had average student achievement scores over 30 points higher than district averages for the grade level.

  The magnets with the highest achievement scores generally have used more selective methods of admitting students.

- Other student outcomes measures, including average daily attendance and dropout, suspension and transfer rates, show that magnet schools have more positive outcomes than district averages, which is a function of voluntary enrollment and self-selection.

PLANNING A MODERN AVIATION MAGNET HIGH SCHOOL

Throughout this publication there are examples of what one person has done in designing an educationally attractive program of learning based on an aviation or aerospace theme. Furthermore, there are examples of what an entire community of interests can accomplish with proper planning, involvement with interest groups, gathering of demographic, employment and related career information.

A current trend in aviation high school magnet school planning is to look at the national needs for skilled technically competent high school graduates to work as Aviation Maintenance Technicians (AMTs). Even in the current economy with many companies, including aviation employers, reducing their workforce - there is a need for Aviation Maintenance Technicians.

An outstanding example of how to prepare a basic document justifying such a program is that prepared in November of 1992 by Ms. Maxine Smith, Project Manager for Aviation Projects and Programs of the Port of Oakland, California. Ms. Smith has documented the community - education - industry - labor - government cooperation that has led to the establishment of what will become a truly 21st century aviation education magnet school focused on preparing young people, starting in high school, to be well paid, qualified, Aviation Maintenance Technicians.

The document she prepared is entitled, "Information Packet on Castlemont Aviation High School Program, Oakland Unified School District, In Association With Oakland Aviation Maintenance Technical Advisory Committee, Oakland, California."

Following are relevant excerpts from this excellent report.

> "The Aviation Program will establish Castlemont as a Magnet Academy for all district students interested in aircraft maintenance careers. It is estimated that Castlemont will be graduating between 200-300 Aviation participants annually. Local A & P programs in adult training programs currently graduate approximately 400 certificated A & P

mechanics annually. Over the long-term, the District envisions the Aviation High School Program would be well equipped to broaden the availability of other vocational programs affiliated with aviation as well as other industries that utilize similar skills."

CASTLEMONT AVIATION HIGH SCHOOL PROGRAM FACT SHEET

ELEMENTS OF THE PROPOSAL

1. Evidence of Broad Partnerships

The Aviation High School Program is supported by an advisory committee comprised of numerous organizations representing education, labor, business and industry and the local community. Section I, (B) lists members of the Advisory Committee.

2. Program Design

Consultation with local private industry councils is important in the design of the Program as is the relevancy of the training to the labor market. The Oakland Private Industry Council and the local aviation business community have been active proponents and supporters of the Aviation Program in the Oakland School District. An Aviation Maintenance Technology training program is one of the most relevant vocational programs that exists today. The curriculum is explicitly described by Federal Aviation Regulation (FAR Part 147) and is closely monitored by the FAA and the aviation industry to ensure that Program graduates have the skills necessary to meet demands. The skills acquired in this Program are proven to be transferrable to other industries.

The choice of this Program was predicated on extensive labor market research and local industry projections. A report issued by the General Accounting Office (GAO) in 1990 supports this analysis, projecting the need for significant additional aircraft maintenance capacity. Section III, Employment Opportunities, discusses in further detail labor projections in this area.

Local Employer Participation - Local employers have committed to participation in curriculum development, mentoring, summer employment, placement, etc. These employers are committee members and have been active supporters of this Program since its inception. United Airlines has adopted the Aviation High School Program and with that adoption comes active support in providing technical expertise towards ensuring a relevant curriculum, in mentoring students, in providing summer internships, sponsoring field trips and providing placement assistance. All of this support is provided in association with the labor union which represents aircraft mechanics and with other local employers. Sections III (C) and IV (C), respectively, discuss local opportunities and participation.

Academic Instruction - Prior to committing to this Program, leaders and staff from the Oakland School District visited a similar program in New York to ensure that the Aviation curriculum could be successfully integrated into the general high school curriculum and would meet California State Frameworks for secondary education. Not only is this Program compatible, but will enhance academic training through applied coursework, relevant to vocational skills training.

Work-Based Learning - The FAA specifies the basic curriculum and skill requirements for this Program. This is based on industry standards for knowledge and skills required of entry-level aircraft mechanics. The industry relies on these programs to supply them with well trained, reliable employees.

Vocational class size is limited to a maximum of 25 students per instructor. The Aviation Program is designed to provide each student with hands-on training. Each student is continually tested to assure that they can demonstrate competence in each functional area.

The industry demands that an aircraft mechanic be responsible, reliable and competent. The development of these attitudes and sound work habits are part of the training. The FAA mandates the number of hours of vocational training necessary for a mechanic to obtain his or her certificates. Good attendance is mandatory for a student to successfully complete this Program. See Section IV (A), Program Definition and Academic Instruction for further detail.

Work-Site Learning and Experience - The Aviation Program not only requires demonstrated skill in manual tasks, but requires a keen understanding of how aircraft components work. This requires that a student successfully demonstrate knowledge of general science, applied physics, mathematics and basic electronics. The local district of the machinists union, along with other industry representatives, have committed to mentoring and tutoring students in this Program. These graduates will eventually be working along-side these industry professionals and it is in their best interest to make sure that these new-hires possess the skills and knowledge necessary to be valuable, competent co-workers. Not to mention the fact that these graduates will be working on aircraft that employees and family members fly on.

It is the District's goal to provide each student in this Program with 200 hours of paid work experience. This goal will be achieved through summer internship programs, in conjunction with local labor union rules and regulations. See Section IV (C), for further detail.

Youth Apprenticeship Agreements - The District has both experience and success with incorporating Youth Apprenticeship Agreements with existing Academies programs and summer internship programs. These agreements have been used to solidify participation and commitment from youth, parents, employers and by the school.

Information and Guidance - Information on opportunities, job qualifications and options for post-secondary education will be an integral part of this Program. Student outreach will begin at the junior high school level to provide students the opportunity to learn about the Program, to motivate students to achieve the academic and attendance standards necessary to complete the Program and to assure that the Program attracts a sufficient number of students to be successful.

Committee members have committed to mentor students and to participate in an advisory role to provide information and guidance on how to gain employment and prepare for upward mobility once on the job. The school district can also benefit from assistance from the FAA's Office of Aviation Education in getting information on opportunities in this field. See Section IV (H), Information and Guidance for further detail.

3. Linkage to Other State and Local Initiatives

The establishment of an aviation training program is compatible with the District's Five-Year plan and has been endorsed by the Superintendent of Public Instruction for the State Department of Transportation.

The contribution of school funds to this Program will be significant. Sources of these funds will include state allocations and City of Oakland Redevelopment Funds. Additional monies are anticipated from Carl Perkins grants and private philanthropic organizations. Although District monies will make up the greatest percentage for supporting the Program once it is underway, start-up costs require additional funding assistance. Given the significant financial commitment necessary to make this program a success, grantsmanship efforts will be an integral part of program implementation. Grantsmanship activities are currently being donated in-kind by staff at the Oakland School District and the Port of Oakland. See Section IV (B), Program Approach and Linkage to Other Initiatives, for further detail.

4. Delineation of Steps for Recruitment and Marketing to Students

The student awareness program will be multifaceted in its implementation. It will be based on successful models used by the District for the existing magnet and academy programs. The plan, in summary, includes, but will not be limited to, field trips, presentations by aviation educators and industry representatives, and career fairs. The Oakland School District excels in its ability to distribute information by way of its own, widely viewed, cable television system. A more detailed description of the awareness program is included in Section IV (H), Information and Guidance.

5. Plans for Assisting School, Teachers, Employers, etc., in Job Analyses, Curriculum Development and Staff Development and Training

The District is in the process of hiring a consultant team led by Dr. Gene Little, formerly Chairman of the Aviation Department at San Jose State University. Both Dr. Little and his associate, Vito Ciarfaglio, have direct experience in establishing an FAA certified Aviation Maintenance Technology Program on both the adult and secondary school levels. These educators bring to the District extensive knowledge and experience in both the aviation industry and aviation education. Dr. Little and Mr. Ciarfaglio will assist the District in curriculum development, job analyses and staff development and training, in addition to other project implementation tasks and assignments. The Port of Oakland and the City of Oakland have provided the seed money to get this effort underway.

Monies have been budgeted by the District for funding staff development training. Staff support for the program will be an integral part of its success. The District will be working with the aviation industry to develop and participate in training programs designed for high school level educators to integrate aviation coursework and relevant examples into academic training.

6. Description of How the Training Area Was Chosen and How Businesses and the Community Were Solicited

The impetus behind this program began over a year ago when community leaders approached Oakland businesses to determine which industries and areas of training would bring better employment opportunities for the community's youth. This effort was and continues to be based on the philosophy that the long term solution to the community's problems consists of good education and decent employment. These discussions led to research and interest into this training area. See Section I (A), Background, for further detail.

7. Description of Approach and Key Date Schedule

The Aviation Maintenance Technology Program will be based on a similar program currently established at the Aviation High School in Queens, New York. The Program will be based on an Academy Model which has highly successful results in District programs. Following a "school-within-a-school" concept the academy model is designed to provide academic instruction and career awareness.

The District currently has a number of Magnet school programs designed to prepare students for college entrance and/or entry-level jobs. These include programs in Computer Technology, Pre-Engineering, Health and Biotechnology and Media-Communications. Based on historical results at the Aviation High School in Queens and Oakland goals for academy programs, the District predicts that 60% of the AMT Program graduates will be going onto higher education.

Portions of the A & P Program will be phased so that graduates can matriculate into an existing A & P program at College of Alameda. These students would only be required to take those elements of the program which were not yet certified at the high school. In approximately four to five years, the Oakland program would be fully certified in at least one of the two certificated areas. It is envisioned that a fifth year would be offered for those students interested in obtaining both certificates. The General Aviation portion of the AMT Program will be offered as the first phase of the curriculum and could begin September, 1993.

The District and the Advisory Committee foresee that the success of the AMT Program will be enhanced by broadening its curriculum to include training in other technical fields that utilize similar skills. The utilization of the program facilities could also be maximized by offering adult programs in these areas. See Sections IV (B) Program Approach and IV (G), Key Date Schedule for further detail.

8. Evaluation Plan

The District provides for monitoring and evaluation of all of its educational programs through its Department of Research and Evaluation. In addition, the District provides for both internal and independent financial audits of its revenues and expenditures, including compliance requirements. This program will come under scrutiny from many areas: the educational community, parents, funding institutions and industry. It welcomes and will encourage participation and constructive criticism in ensuring the program's success.

It is the intent of the District, as with other programs, to provide for monitoring and evaluation procedures commensurate with the above as applicable to the Aviation Program. Section IV (K), Evaluation and Performance Measures discusses in further detail the criteria currently used by the District in evaluating academy programs.

I. INTRODUCTION

A. The impetus behind this program began over a year ago when community leaders approached oakland businesses to determine which industries and areas of training would bring better employment opportunities for the community's youth. This effort was and continues to be based on the philosophy that the long term solution to the community's problems consists of good education and decent employment. These discussions led to research and identification of a field where training is achievable at the high school level and will result in graduates who can take advantage of excellent employment and educational opportunities. This field is Aviation and the Program begins with training in Aircraft Maintenance Technology (AMT).

On April 27th and 28th of 1992, fifteen education, community and business representatives from Oakland were sponsored by United Airlines and the Port of Oakland to visit the Aviation High School located near La Guardia Airport in Queens, New York. This high school serves approximately 2,000 students and offers a unique combination of vocational and academic courses. What most impressed these representatives was the pride, motivation and discipline of the students.

Since that visit, the community, educators and leaders from the aviation industry have been working toward establishing a similar program here in the Oakland School District. The establishment of the Aviation Program represents a fundamental change in how our schools and industry work together and this effort represents a unique partnership as emphasized under National Youth Apprenticeship, in conformance with the goals of America 2000.

B. Evidence of Broad Partnerships

The Oakland Unified School District, in association with the Oakland Aviation Maintenance Technology Advisory Committee (OAMTAC), proposes the establishment of the Aviation Technical Training Program at Castlemont High School in Oakland, California (Figure 1). The OAMTAC is comprised of leaders representing the City of Oakland, Oakland Unified School District (the District), Private Industry Council (PIC), Oakland Community Organization (OCO), Port of Oakland, Tuskegee Airmen, International Association of Machinists and Aerospace Workers, United Airlines, Oakland

Chamber of Commerce (OCC), and the Peralta Community College District (PCC). This advisory committee was formed as a partnership between education and industry to assist the school district in developing and implementing a real-world vocational and academic program that will help high-school students obtain job-skills that are rewarded with well-paying, career-oriented jobs upon graduating from high school, simultaneously addressing the future employment needs of the surrounding community. The OAMTAC has initiated and sustained incredible momentum in moving this program forward and is firmly committed to its success.

Under the leadership and direction of the Oakland Unified School District and representatives of the OAMTAC, Castlemont High School will offer its students an aviation maintenance technology (AMT) training program as part of the high school curriculum. This vocational program would be an outstanding model demonstrating the success of a comprehensive program that is responsive to the needs of the students in the public school system and the employment needs of local businesses.

Figure 1
Evidence of Broad Partnerships
Members of Aviation Technical Advisory Committee

Education

- Alameda County Board of Education
- Oakland Unified Schools
- Peralta Community College District
- Alameda County Superintendent of Schools

Business and Industry

- United Airlines
- Port of Oakland
- Oakland Chamber of Commerce

Labor

- International Association of Machinists and Aerospace Workers
- Private Industry Council

Community

- City of Oakland
- Oakland Community Organizations
- Tuskegee Airmen
- Leadership Oakland

Broad based community and private sector involvement is essential to the success of this Program. The OAMTAC (the Advisory Committee) has brought together leaders representing education, business and industry, labor and the community. The advisory Committee's goal is to provide the support necessary in developing and implementing a curriculum which provides significant opportunity for continued education and career development. These representatives have and will continue to provide support through:

1) Financial contributions and solicitation;
2) In-kind contributions (e.g. staff time and transportation);
3) Curriculum guidance;
4) Career guidance;
5) Tutoring;
6) Summer employment, and;
7) Placement assistance.

The goals of this committee are directly related to the Department of Labor and Department of Education model for Youth Apprenticeship and national policies for strengthening the connections between school and work.

II. SERVICE DELIVERY AREA

A. The District

The Oakland Unified School District is the sixth largest district in the State of California. Currently, it serves 52,000 students from kindergarten through grade 12. In addition, 25,700 adult school students and 2,544 preschool children are served by the District.

Student Population

Elementary	31,964
Middle/Jr. High	10,456
Sr. High	9,482
Adult Students	25,700
Preschool Age Children	2,544
Total Students Served	80,146

Schools

Elementary (12 Year-Round)	59
Middle/Jr. High	16
Sr. High	9
Adult Education Centers	4
Child Development Centers	22

The district's student population reflects Oakland's rich ethnic diversity and is 54.6% African American, 17.4% Hispanic, 8.2% white, 19.3% combined Asian and 0.5% other, including American Indian. Oakland is considered one of the most ethnically diverse cities in the United States.

Fifty-two percent of Oakland's students receive Aid to Families With Dependent Children (AFDC) and 13,215 are Limited English Proficient (LEP). The district is involved in an active recruitment campaign to increase its number of bilingual, special education, math and science teachers.

The Oakland school district is governed by a seven member Board of Education, elected by district and which oversees an annual budget of $293 million. Ninety-five percent of the district's budget comes from State Contribution, 4.9% from Lottery and local contributions, and 0.1% from federal funding sources.

In spite of declining resources, the district is making every effort to maintain effective instructional programs and provide for the needs of its diverse student population. Programs in bilingual education, special education, early childhood education, gifted and talented education, vocational education, advanced placement courses and teen parenting instruction supplement the core curriculum. Ongoing partnerships with colleges, universities and the business community are an integral part of the district's planning process for educational improvement.

B. Overview: Oakland

Oakland is nationally known for being one of the most ethnically diverse and integrated cities in the nation. The city's population is made up of almost 50% African Americans, with the other 50% divided among Caucasians, Latinos and Asians. It is one of the few cities where people of different ethnic and racial backgrounds live side by side and whose children attend the same schools. Many of Oakland's schools have up to 17 languages represented. In terms of economic strength, The Port and Airport make Oakland a vital transportation hub.

Unfortunately, Oakland is also nationally known for having one of the highest per capita murder rates. Oakland is plagued by a drug epidemic, poverty and a high rate of high school drop out. To a great extent these conditions have stemmed from economic and social trends which have created widespread unemployment and underemployment. Like many cities, Oakland has lost thousands of manufacturing jobs since the 70's. At the same time Oakland's manufacturing base declined, Oakland public schools de-emphasized vocational education. High school shops which once trained students in practical skills have sat empty for the last ten or more years. Hence, young people in Oakland who are not college bound have had less access to training which would prepare them for decent paying jobs in manufacturing and technical fields. What "blue collar" jobs still exist in Oakland have become increasingly out of reach for Oakland residents. The net result of these trends has been disastrous. Families have suffered declines in income. Children and young adults face a bleak future and are easily attracted by the lucrative lure of drug activity. Neighborhoods have deteriorated.

In order to become revitalized, Oakland must seek to create linkages between its employment base and the community. The Port, Airport and other business centers will continue to need qualified workers, but these jobs will only go to Oaklanders if they are prepared. Any sort of progress will require broad collaboration among business community, school and city government leaders.

III. EMPLOYMENT OPPORTUNITIES

A. Current Employment

In 1991, over 82,000 aircraft mechanics were employed in the U.S. Close to 70,000 mechanics were employed in maintaining the airline industry's estimated 4,100 aircraft. Over 59,000 mechanics were employed by major airlines, with the remaining employed by National and Regional air carriers and corporate aircraft operators. There are currently 12 "major" U.S. airlines maintaining over 3,600 aircraft at maintenance bases located throughout the country. Mechanics employed by major airlines had an average starting pay in 1991 of $12.47 per hour.[1] The average maximum pay at a major airline for a mechanic with an A & P license is $19.00 per hour. Figure 2 shows the distribution of A & P mechanics among the various airline categories. Figure 3 shows the locations of maintenance facilities for the major airlines, total number of mechanics employed, the carrier's fleet size and projections for new aircraft.

---

[1] This does not include added pay differentials/premiums for evening/night shift work and licenses.

Figure 2
Distribution of Aircraft Maintenance Employment

Airline Categories	Annual Gross Revenues	Aircraft Mechanics
Major Airlines	$ 1.0 Billion	59,249
National Airlines	$ 1.0 Billion to < $100 Million	5,314
Turbojet Airlines	Less than $100 Million	1,163
Regional Airlines	Operate Propeller Driven Aircraft	4,190
Helicopter Operators	Operate Helicopters	2,831
Additional Companies	Includes General Aviation and Third Party Maintenance	9,702

Figure 3
Major U.S. Employers of Aircraft Mechanics

Airline Name and Maintenance Base Locations		Mechanics Employed	Aircraft In Fleet	Aircraft On Order
ANCHORAGE AIRLINES		880	63	52
Anchorage	Juneau			
Fairbanks	Los Angeles			
Long Beach	Oakland			
Ontario	Portland			
Seattle				
AMERICA WEST		1,000	119	94
Las Vegas	Phoenix			
AMERICAN		7,500	560	188
Los Angeles	Denver			
San Francisco	Atlanta			
Miami	Chicago			
Honolulu	Raleigh-Durham			
Tulsa	San Juan			
Nashville	Dallas			
New York				
CONTINENTAL		5,000	337	95
Los Angeles	Honolulu			
Newark	Houston			
Denver				

DELTA		8,000	447	180
Los Angeles	Seattle			
San Francisco	Ft. Lauderdale			
Orlando	Tampa			
Atlanta	Chicago			
New Orleans	Boston			
Detroit	Cincinnati			
Portland	Dallas			
Houston	Salt Lake City			
FEDERAL EXPRESS		1,400	378	13
Los Angeles	Memphis			
Oakland	Chicago			
Indianapolis	Newark			
NORTHWEST		6,500	335	169
Seattle	Atlanta			
Boston	Washington, D.C.			
Detroit	Minneapolis			
New York	Memphis			
SOUTHWEST		347	106	48
Dallas	Phoenix			
Houston				
TWA		4,500	209	20
Los Angeles	New York			
Kansas City	St. Louis			
UNITED AIRLINES		12,500	466	284
Los Angeles	Seattle			
San Francisco	Phoenix			
Oakland	San Diego			
Denver	Washington, D.C.			
Miami	Orlando			
Atlanta	Honolulu			
Chicago	Boston			
Newark	New York			
Cleveland	Portland			
Philadelphia	Dallas			
Houston	Salt Lake City			
UNITED PARCEL SERVICE		550	125	14
Oakland	Ontario			
Louisville	Newark			
Philadelphia	Dallas			

US AIR		8,452	428	103
Burbank	Orange County			
Los Angeles	San Diego			
San Francisco	Washington, D.C.			
Hartford	Miami			
Jacksonville	Tampa			
Orlando	Chicago			
Atlanta	Louisville			
Indianapolis	Boston			
Baltimore	St. Louis			
Detroit	Albany			
Newark	New York			
Buffalo	Syracuse			
Rochester	Charlotte			
Utica	Raleigh-Durham			
Greensboro	Winston-Salem			
Wilmington	Cleveland			
Cincinnati	Harrisburg			
Columbus	Pittsburgh			
Philadelphia	Houston			
Providence	Norfolk			
Burlington				
Roanoke				

Other Major Employers of Aviation Maintenance Technicians

RYDER AIRLINE SERVICES		3,500
Phoenix	Burbank	
Dallas	McAllen	
LOCKHEED AEROMOD		1,100
Tuscon	Greenville	

Note: The ratio of mechanics to aircraft averages between 14 and 17 technicians per aircraft. The actual number of mechanics per aircraft differs by airline due to the fact that many carriers contract out major maintenance to other airlines such as United Airlines or third party maintenance facilities such as Ryder Airline Services.

B. Employment Projections

Over the next ten years, it is estimated that the aviation industry will need 70,000 new maintenance technicians; 53,000 in large jets and 17,000 in the non-jet regional category. This increase in demand for maintenance personnel can be attributed to a growing demand for air travel, new aircraft on order, an effort to extend the useful life of existing aircraft (older aircraft require more work than newer aircraft), and personnel attrition (at least 50 percent of the current work force will retire within the next 10 years).[2]

A Government Accounting Office (GAO) report completed in 1990 stated that some 1,400 of the U.S. airline industry's 4,100 aircraft will require extensive structural modifications by mid-1994. But, as of April, 1991, only 28 aircraft have completed the structural modifications. Additionally, an increased number of airworthiness directives (ADs) issued by the FAA would further increase aircraft maintenance requirements. Over 100 Boeing 727/737/747 aircraft and more than 1,150 McDonnel Douglas (DC) 8/9/10 and MD-80 aircraft are affected by these ADs.

To meet the demand for aircraft maintenance, the airline industry plans to increase maintenance hangar space by 5.7 million square feet in the next two to three years. Three of such facilities are the United Airlines' Maintenance facility at Indianapolis, Indiana; Northwest Airlines' Maintenance facility in the state of Minnesota; and Pacific Aircraft Maintenance Corporations' facility in Portland, Oregon. It is estimated that structural and corrosion rework will ultimately affect 2,600 U.S. aircraft.

In May, 1992, an industry task force was formed to study future shortages of pilots and aviation maintenance technicians. FAA and the Bureau of Labor Statistics project the need for both civil pilots and maintenance technicians will grow faster over the next decade than for any other occupation - 2.4% annually, compared with 1.2% for all other occupations. Barry Harris, Deputy Administrator for the FAA, said that possible shortages in the two aviation occupations "could have a stifling effect on the continued growth of aviation" and that "we must be prepared to do what we can to prevent a shortage." The task force is chaired by Kenneth Tallman, president emeritus of Embry-Riddle Aeronautical University and includes representatives from FAA, Bureau of Labor Statistics, Air Transport Association, U.S. Naval Academy, Professional Aviation Maintenance Association, Ohio State University, United Airlines, Northwest Airlines, and U.S. Air. The OAMTAC will be keeping abreast of the findings of this panel, in addition to other industry projections for employment needs to ensure that graduate levels match employment demand.

C. Local Opportunities for Employment

Over 11,000 of the 70,000 airline mechanics employed nationwide are currently located in the Bay Area. The largest employer of aircraft mechanics is United Airlines, with close to 7,000 mechanics at San Francisco Airport and 1,400 mechanics at Oakland Airport. American, Delta, TWA and several foreign flag carriers employ over 1,000 mechanics at San Francisco Airport and Alaska Airlines, National Airmotive and Kaiser Aviation employ close to 600 mechanics at Oakland Airport.

---

[2] Source: FAPA, 1991-1992 Aviation Maintenance Directory of Employers.

As recently stated in "Aviation Daily," Alaska Airlines has decided to abandon plans for construction of a new maintenance facility and will, instead, expand their existing facilities currently located in Seattle and Oakland. The expansion of the Oakland facility will further enhance opportunities for local A & P employment.

Figure 4
Major Bay Area Employers of Aviation Maintenance Technicians

Alaska Airlines*
American Airlines
Aris Helicopters
Chevron Corporation
DHL
Federal Express*
Hawaiian Airlines
Kaiser Aviation*
Naval Rework Facility
United Airlines*
Westair/United Express
American Eagle/Wings West
Ameriflight*
Butler Aviation
Delta
Emery World-Wide
Flightcraft*
Hewlett-Packard
National Airmotive Corp.*
United Parcel Service*
US Air
Foreign Flag Carriers

*These employers have major facilities at Oakland International Airport.

It is estimated that up to 30% of the graduates from the Oakland AMT program will enter into fields other than Aviation.[3] One targeted employer of these graduates will be the Bay Area Rapid Transit (BART). Over the next five to ten years, the BART system will be adding service and extending BART lines which will greatly enhance job opportunities for these program graduates. In addition, these graduates will find work in satellite technology and manufacturing, building maintenance, ferry maintenance and other related industries.

D. San Francisco Bay Area Aircraft Mechanic Demand and Available Training

There are approximately 190 FAA certified aviation maintenance technical schools in the United States; twenty four are located in

---

[3] Based on placement statistics at Aviation High School in Queens, New York

California.[4] There are currently eight certified programs in the Bay Area that produce approximately 370 aircraft mechanics annually. This number of graduates is not sufficient to fill the need of 900-1,000 new hires annually. The scarcity of A & P mechanics in the Bay Area has forced United Airlines, Alaska Airlines, National Airmotive and other local operators to recruit mechanics from outside the state of California.

One source for newly certified mechanics has been from the Aviation High School in Queens, New York. This program is a public high school that offers certified mechanic training from the 9th grade level. This program currently graduates 300 mechanics a year. The problem here in the Bay Area is that once new hires gain seniority, they either transfer to a location with a lower cost of living and/or relocate to their previous home. Employers of AMTs in the Bay Area have the lowest attrition rates with new hires who are originally from this area. These employees are often established and find it less difficult to adjust to the cost of living issues unique to the Bay Area.

Figure 5
San Francisco Bay Area Aircraft Maintenance Technology Training Programs

Program Providers[5]/Ownership	Annual Graduates	Avg. Cost
City College of San Francisco/Public	45	$ 1,240
College of Alameda/Public	45	$ 1,240
College of San Mateo/Public	23	$ 1,240
San Jose State University/Public	70	$ 6,800
Sierra Academy of Aeronautics/Private	90	$13,728
Gavilan Community College/Public	12	$ 1,240
John O'Connell School of Technology/Public	7	N/A
Palo Alto Adult School/Public	77	$ 1,520
Total Number of Annual A & P Graduates Locally	369	

United Airlines projects that over the next five to ten years the majority of their new hire mechanic vacancies will be in the Bay Area.

---

[4] A & P Training Programs certified by FAR Part 147

[5] The majority of these programs have waiting lists ranging between 100-300 prospective students

The attrition rate of aircraft mechanics at United Airlines facilities, for example, has averaged 6%, or 700 mechanics a year for the last few years. This does not include those mechanics who transfer to another United Airlines maintenance base. Other aircraft operators at the three Bay Area airports have also experienced similar attrition. In the Bay Area, the rate of transfers out of this area is much higher than the national average. This is mainly due to the Bay Area's high cost of living in comparison to other major aircraft maintenance bases, such as those in Dallas, Atlanta and Phoenix.

IV. PROGRAM DESIGN AND IMPLEMENTATION

A. Program Definition and Academic Instruction

The work of an Aircraft Maintenance Technician (AMT) consist of checking and inspecting aircraft and their components, making adjustments and repairs and overhauling the aircraft and components in keeping with Federal Air Regulations (FARs). Aircraft components include propellers, landing gear, hydraulic equipment, engines, instruments and the airframe itself. The AMT uses basic hand tools and semi-precision instruments, as well as elaborate diagnostic and repair machinery.

The curriculum for the AMT Program is a series of courses which lead to certification. This intensive training is necessary to obtain airframe and powerplant certificates (A & P) issued by the FAA. It is this certification that is the ticket to lucrative and rewarding employment in this industry. There are two major phases to the program: Powerplant Technology and Airframe Technology. Each of these phases is complete in itself in providing students with the theoretical and practical experiences coherent with the practices required by the FAA and the Aircraft Industry.

The Aviation High School Program is committed to providing each student with a solid secondary academic education, coupled with the mandatory training in Airframe and Powerplant Technology. The Aviation Program will include a Federal Aviation Administration (FAA) certified (FAR Part 147) Aviation Maintenance Technician School that will provide graduates with the education and training needed to satisfy the requirements for obtaining their A & P certificates and for pursuing continued training and/or higher education.

High quality work-based learning is assured through a program that includes a minimum of 1,900 hours of certified training; 750 hours of airframe training and 750 hours of powerplant training, plus 400 hours of general coursework in addition to the basic requirements for receiving a high school diploma in the state of California. To successfully complete the program, students are held to stringent attendance and performance standards strictly enforced by the FAA. These standards assure that trainees are qualified when entering the job market and help in development of good work habits and a sense of accomplishment.

It is anticipated that many students will take this education and training on to higher learning in aviation/aerospace programs as well as other areas. Students seeking advanced training will be well prepared to enter programs for engineering, management and other technical fields that will lead to rewarding careers in both the public and private sectors. In addition, the skills and certificates obtained through this Program can be applied to other industries such as the fabrication and maintenance of light and heavy rail vehicles, heavy equipment manufacturing and maintenance, and trades in other fields such as heating, ventilation and air conditioning (HVAC), and entry into highly-skilled jobs in the government and military services. In addressing the needs of the community, investment in this training program's facilities can be maximized by integrating A & P training into existing adult education programs.

B. Program Approach and linkage to Other State and Local Initiatives

The Aviation Maintenance Technology Program will be based on a similar program currently established at the Aviation High School in Queens, New York. The program will be based on an Academy Model which has highly successful results in District programs. Following a "school-within-a-school" concept the academy model is designed to provide academic instruction and career awareness.

The district currently has a number of magnet school programs designed to prepare students for college entrance and/or entry-level jobs. These programs include:

Figure 6
Oakland Magnet Academy Programs

Program	School
Computer Technology	Castlemont
International Trade and Transportation	Castlemont
Media-Communications	Fremont
Visual Arts	Oakland High
Health and Biotechnology	Oakland Tech
Pre-Engineering	Oakland Tech
Performing Arts	Skyline
Business and International Finance	McClymonds
Law and Government	McClymonds

The purpose of these magnet programs, as well as those in other high school sites in the District, is to provide students with the skills, knowledge and attitudes needed for entry level employment and/or advanced study in a particular career field. Current and future local employment trends indicate a need for preparation in these career fields.

The establishment of an Aviation High School in Oakland School District fits well in achieving the goals of its five-year plan. This plan is intended to provide systematic, student-centered and site-based approaches to improving education in the Oakland Public Schools. This comprehensive, well-planned approach to implementation of academic, vocational and attitudinal programs will guide the district in greatly improving the education of students in Oakland public schools. The District's Five Year Plan demonstrates its commitment to achieving long range improvements for education and outlines measures for development, implementation and evaluation of sustainable programs that truly meet the needs of the urban community it serves.

C. Local Participation and Work-Site Learning

Success in the aviation program not only requires that students be able to demonstrate skill in manual tasks, but requires that they understand the principles behind how aircraft components work. This requires that a student has a high level of reading proficiency before graduating from the program and that they successfully demonstrate knowledge of applied physics, mathematics and basic electronics. The FAA approved curriculum is extremely relevant to the skills and knowledge required from the work place. Representatives from the OAMTAC have committed to student mentoring, tutoring and summer employment. United Airlines has adopted Castlemont High School into its Adopt-A-School program and, as a result, students will benefit from field trips, scholarships, training and placement assistance.

It is the District's goal to provide each student in this program with 200 hours of paid work experience. This goal will be achieved through summer internship programs, in conjunction with local labor union rules and regulations. United Airlines, for example, requires that students be 16 or older before they are allowed to participate in internship programs. Given the level of maturity and responsibility needed when working around aircraft maintenance activity, it is likely that internships will be limited to qualified students at the junior and senior class levels.

As with other internship programs throughout the District, funding would come from state and local sources. The District currently receives over $200,000 from City Redevelopment funds and State Partnership programs for student stipends.

D. Project Management and Program Phasing

The District is in the process of hiring a consultant team with direct experience in establishing an FAA-certified Aviation Maintenance Technology Program, in training A & P mechanics and with real-world aviation experience. These individuals will assist the District in the following tasks: 1) curriculum development, 2) forecasting financial needs and preparing a budget, 3) preparing a phasing plan for matriculating the students involved in the first few years of the program, 4) establishing and implementing a training and orientation program for the educators to be assigned to Castlemont, 5) recruiting additional FAA-certified A & P instructors, 6) preparing facility renovation plans and 7) developing and implementing the awareness program for recruiting students from the District.

In order to gain FAA certification for an Aviation Maintenance Technology Program, the instruction, facilities, equipment and program must be underway. The FAA requires that the program be fully documented in training manuals that are stamped, page by page, by an FAA Part 147 Inspector. Certification of classroom training and laboratory course work would be certified on an on-going basis, course-by-course. It is estimated that it will take the District four years before all the coursework in the A & P curriculum is fully certified.

To ensure that students entering the program the first few years are able to acquire their A & P certificates, the District is working with the nearby Peralta Community College District to provide uninterrupted training for AMT students within an existing, certified A & P program. Students would be given priority entry into Peralta's A & P training courses offered through the College of Alameda.

The consultant team will be responsible for developing an implementation plan so that coursework certification and student matriculation would run parallel. It is a multi-year process for implementing this program and the development of a detailed implementation plan is essential to its success.

There are three major phases to implementing the AMT program. Phase I of this program will focus on the general portion of the A & P program. The initial program will concentrate on providing students with the fundamentals of aviation, improving basic skills in reading and mathematics and will include some shop training.

Phase II of this program will emphasize the Airframe portion of the A & P program and Phase III will cover Powerplant Technology. Phase III will be offered either in a fifth year program, or within the 2 + 2 matriculation into Peralta Community College.

E. Site Selection

There are currently nine high schools operating in the Oakland Unified School District. Among the criteria used for site selection were existing capacity and compatibility with the District's Five-Year Plan. The Castlemont High School Site was selected based on its compatibility with existing programs and its physical plant's ability to handle the various shop facilities. The development of the Aviation Maintenance Training Program will attract Oakland high school students, and other adults in the community to encourage them to participate in adult education courses which will be offered in this program.

The existing Transportation Academy has received high accolades from the District and the community. The Transportation Academy includes a core group of instructors with real-world experience in the transportation fields. They include a Navy fighter jet pilot and a certified A & P mechanic. These instructors have the motivation, talent and working relationships to make this program succeed. The principal of this school fully supports the program and recognizes its value in motivating both students and instructors.

F. Facility Requirements

The existing Castlemont facility is estimated to accommodate the training needs for up to 300 A & P students. The District is currently taking inventory of the existing shop equipment to assess equipment needs. Details are being worked out with the Department of the Navy, Government Services Administration (GSA) and United Airlines in the procurement of close to $1 million worth of equipment for this program. United Airlines has already committed to the Castlemont program the nose section of a Boeing 727 aircraft.

An AMT program must provide shop training in four primary areas: wood-working, powerplant, sheetmetal and hydraulics. The facility and equipment requirements for this type of program are extensive. The Castlemont facility has the necessary floor space for these workshops. Although a large percentage of the equipment will be donated, there will be some costs for tools, equipment and renovation of the workshop areas. It is anticipated that some materials will be donated and local tradesmen and women will be donating their expertise in renovating the facilities. Part of the duties of the Project Manager will be to coordinate this effort.

G. Key Date Schedule

The following is a preliminary schedule for implementation of the AMT program. The consultant team currently being hired to manage the program will be refining this schedule and providing more detail as we progress in the Planning and Assessment Phase.

Figure 7
Task List and Key Date Schedule

	Task/Assignment	Dates
1.	Planning and Assessment	June, 1992 through Jan., 1993
2.	Curriculum Development	Jan., 1993 through April, 1993
3.	Student and Parent Awareness	January, 1993 - Ongoing
4.	Staff Development	January, 1993 - Ongoing
5.	Facility Renewal	Oct., 1992 through Jun., 1993
6.	Student Enrollment	April, 1993 - Ongoing
7.	Program Implementation (Phase I)	Begins September, 1993
8.	Advisory Committee Meetings	Ongoing and As-Needed (Bi-Weekly - Monthly)

H. Information and Guidance

The student awareness program will be multifaceted in its implementation. It will be based on successful models used by the District for the existing magnet and academy programs. the plan, in summary, includes, but will not be limited to the following characteristics:

Student Awareness Programs: Students will be counselled each year in a timely fashion so that they may have substantial awareness of the Aviation Program. They will be provided opportunities to fully explore this field and qualifications and requirements will be fully discussed. Field trips, speakers and a carer fair will be an integral part of the program. The District will take advantage of existing educational and vocational information readily available through the Federal Aviation Administration's Department of Aviation Education and through industry organizations such as Future Airline Professionals of America (FAPA). Field trips will be sponsored by United Airlines, Oakland International Airport and other local employers.

Students may apply for the Program based on District policies and procedures so that eligibility and placements can be determined in advance of the beginning of each course sequence.

Public Awareness Program: The District has a public relations department responsible for multi-media information, press releases, development of multi-linguistic communication and other press and electronic communications.

In addition, the District operates its own widely viewed cable television system that is able to reach every home in the District. This system is not only used for announcement and public information, but also for interactive education.

Public/Private Entity and Community Relationships: The academy model applicable to the proposed Program includes a business, community and other public agency advisory board for each career discipline. This Board provides important technical, economic and socially related input into guiding the planning, process and operation of each program. It is the intent to replicate this model for the Aviation Program. This will provide technical and community support,and serve as an important method to disseminate information and enhance public awareness.

Castlemont High School feeder schools will be targeted with outreach activities to prepare students for the Aviation Program. All junior high/middle schools throughout the District will receive information on the Program and will have access to orientation activities.

The Oakland School District excels in its ability to distribute information by way of its own, widely viewed, cable television system.

I. Youth Apprenticeship Agreements

The District has both experience and success with incorporating Youth Apprenticeship Agreements with existing academy programs and summer internship programs. These agreements have been used to solidify participation and commitment from youth, parents, employers and by the school.

J. Program Funding and Grantsmanship

Funding sources affecting District career, vocational and technological education programs include, but are not limited to the following:

1) State and local base revenue limits (averaging $3,300 per student ADA),
2) City Redevelopment funds of $1,230,000,
3) Title 5 Voluntary Integration Funds ($7.6 million), State and Federal School Partnership and Academies funds ($190,000),

4) Carl Perkins Act funds ($600,000) and numerous other state and federal categorical funds such as those from Chapters 1 and 2, Title VII, Title IV, EIA/SCE, Special Education and other Vocational Act resources.

The District will be using funds from the above resources as well as other grants and in-kind services and contributions for the Aviation Program. In addition, it will be working collaboratively with local and regional private and public agencies and with local community organizations in order to meet the costs of the aviation program. These entities have been involved in developing the program and are committed to its success.

The contribution of school funds to this program will be significant. Sources of these funds will include state allocations, additional monies per student from Carl Perkins funds and City of Oakland Redevelopment Funds. Although these monies will make up the greatest percentage of support for the program, once it is underway, start-up costs require additional funding assistance. Given the significant financial commitment necessary to make this program a success, grantsmanship efforts will be an integral part of the program implementation. Grantsmanship activities are currently being donated in-kind by staff at the Oakland School District, the Port of Oakland and by members of Leadership Oakland.

K. Evaluation and Performance Measures

The District provides for monitoring and evaluation of all of its educational programs through its Department of Research and Evaluation. In addition, the District provides for both internal and independent financial audits of its revenues and expenditures, including compliance requirements. This program will come under scrutiny from many areas: the educational community, parents, funding institutions and industry. It welcomes and will encourage participation and constructive criticism in ensuring the program's success.

With the assistance of and input from the specific discipline areas, the District regularly uses, but is not limited to, the following types of criteria:

1. State and local pre- and post-testing based on both normative procedures and criterion referenced approaches for both statewide and specification tests,
2. Anecdotal records, depending on the programs involved,
3. Opinion surveys,

4. Career path testing and evaluation,

5. Post graduate follow-up surveys related to continuing education or career path outcomes.

It is the intent of the District, as with other programs, to provide for monitoring and evaluation procedures commensurate with the above as applicable to the Aviation Program. Milestones and overall evaluation processes will involve testing, surveys, attendance, grades, anecdotal information, accounting and audit data and other pertinent information. Reports will be provided based on milestone and regularized time periods.

There is no substitute for good planning in creating any quality education program. The authors of the 1983 survey, cited above, eloquently testify to this point in describing one of the findings in their study:

> "The districts in our study that did not improve the quality of education with magnet schools were characterized by weak district leadership of the program, low policy commitment to magnet schools, and little planning and program development in the schools."

It is obvious that the Castlemont High School Aviation Program has already had a highly professional and comprehensive planning effort underway. In many respects, the Oakland School District's planning initiatives represent a model that any school system will benefit from studying before they attempt to plan a similar high school aviation magnet program.

"... I want to point out that I believe that magnet programs, especially magnet programs such as aerospace magnets, may be leading the way in demonstrating how to reverse the decline in student achievement and make other important contributions to meeting our national goals, especially in the areas of mathematics and science."

Alicia Coro

SECTION XIV - EVALUATING MAGNET PROJECTS, ACTIVITIES AND PROGRAMS

The term "magnet schools," as pointed out earlier, has a range of meanings. The historic early magnet schools were designed in terms of the literal meaning - to attract. Boston Latin School, Lane Technical School in Chicago, Bronx School of Science in New York and New York's Aviation High School are well known examples. But many school systems have designed and operated aviation-oriented elementary and secondary programs that ranged from small amounts of time devoted to aviation to entire year long and three to four year concentrations on using aviation both as an area of knowledge and as a means to enhance learning of basic subjects.

Despite the widespread uses of aviation education, there has been little documentation of its effectiveness in formal studies. Probably the most effective way to evaluate the benefits of aviation education is to examine what happens to graduates of such programs. On this score it is clear that many young people have been prepared to enter the workforce or college and succeed.

FEDERAL GOVERNMENT DEFINITION OF MAGNET SCHOOLS

It has only been since 1976 that the federal government has shown interest in supporting the planning and implementation of magnet schools to help school districts achieve desegregation goals. This action was manifest when the United States Congress passed an amendment to the Emergency School Aid Act (ESAA) in 1976. This legislation permitted grants to school districts for magnet programs to aid in carrying out desegregation plans.

It should be noted that before and since 1976 many magnet school programs were developed without federal funds. This was done because communities realized the positive benefits of the magnet concept for educating students.

According to a 1983 U.S. Department of Education Survey of Magnet Schools:

> "In the first year of ESAA magnet funding in 1976, only 14 districts applied, but by 1980 over 100 district applications were received by the Department of Education and 65 programs were funded at a total of approximately $30 million per year."

The survey went on to report:

> "By the early 1980's, the number of districts that had implemented magnet schools had grown far beyond the federal role in support of programs. The concept had attained its own popularity due to the combination of urban school districts' needs and the interests of parents, students and communities in education innovation."

The study found "... that more districts have now developed magnet schools without federal support (74) than received ESAA magnet grants in the last year of funding (64 in 1981-82)."

The current federal legislative authority is known as the Magnet Schools Assistance Program (MSAP). The MSAP is authorized by Title III of the Elementary and Secondary Education Act (ESSA) of 1965 as amended by Public Law 100-297-April 28, 1988. As John T. McDonald, Assistant Secretary, Office of Elementary and Secondary Education, U.S. Department of Education has recently stated:

> The MSAP "...provides Federal financial assistance for projects in magnet schools that are part of approved desegregation plans that local educational agencies (LEAs) are implementing."

In order to plan an effective evaluation of a federally funded magnet school one needs to understand what the law stipulates. According to Section 3003 of Public Law 100-297:

"It is the purpose of this title to support, through financial assistance to eligible local educational agencies -

> "(1) the elimination, reduction or prevention of minority group isolation in elementary and secondary schools with substantial portions of minority students; and
>
> "(2) courses of instruction within magnet schools that will substantially strengthen the knowledge of academic subjects and the grasp of tangible and marketable vocational skills of students attending such schools."

It is clear that many, if not all, of the various curriculum options and models of programs cited earlier in this publication meet the criteria of magnet schools as defined by the federal government regardless of whether or not the school districts receive federal funding. In short, objective evaluation of aviation education programs in general and magnet programs in particular must be based upon their purpose or objectives.

LEARNING THROUGH AVIATION EFFECTIVENESS

As pointed out earlier, the landmark study of the Richmond, California School District Program is the first example of the use of a study group matched with a control group to evaluate an aviation education program. By every possible criterion, the Richmond School District students showed significant behavior changes in school work, at home and in their lives in general. In fact, the Richmond studies and experience have influenced hundreds of communities and school districts in planning aviation education programs. Unfortunately, there is no current similar study either underway or planned.

EVALUATION STUDIES DONE SINCE THE 1969 AND 1976 RICHMOND STUDIES

The U.S. Office of Education funded a study in 1981 and 1982 published in September, of 1983 entitled: "Survey of Magnet Schools Analyzing A Model For Quality Integrated Education."

In 1992 a U.S. Department of Education funded study entitled: The Effectiveness of New York City's Career Magnet Schools: An Evaluation of Ninth Grade Performance Using An Experimental Design was done as an evaluation of ninth grade performance.

At the present time a research study is underway, funded by the Department of Education, on the topic of: Magnet Schools and Issues of Public School Desegregation, Quality, and Choice. When this two-phase study is completed, there should be information available to help those who plan to develop magnet programs, especially those based on federal funding.

A good method to use when starting an aviation education program is to consult with those who have similar programs and obtain their advice. Also, excellent programs usually are designed with identifiable tasks, competencies or behaviors that are known in advance by the students. It is a simple procedure to develop a checklist of the tasks or competencies required and evaluate the performance of each student.

An important form of evaluation is to do follow-up surveys of graduates of a program. Have they gone on to college? If so, how have they done? Employers of graduates are excellent sources of an evaluation of how well prepared the graduates were when hired and how well they are now performing their duties.

Finally, graduates of a program should be asked how well they feel the program helped them. This is especially true for career-oriented or skill based programs.

Above all, any new aviation education magnet program plan, regardless of its source of funding, is not complete unless it includes an evaluation process.

The many programs described in this publication represent a good place to start in developing an evaluation plan. The directors of these programs have been very generous in sharing their experiences. Anyone interested in developing an evaluation strategy and plan for an aviation magnet program is advised to consult with one or more of these experienced program directors.

"Aerospace magnets seem typically to include high standards, an orientation to results and strong partnerships with both industry and governmental agencies that are involved in aerospace activities."

Alicia Coro

EVALUATING

SECTION XV - THE FIRST NATIONAL SURVEY OF SECONDARY AVIATION MAGNET SCHOOLS - A PRELIMINARY REPORT

The following material includes preliminary results of the first national survey of aviation magnet schools. This survey was designed and conducted by Mr. Frank G. Mitchell of Beech Aircraft Corporation. Mr. Mitchell has many years of experience in aviation education, marketing, training and administration in the aviation industry.

Anyone planning an aviation magnet high school program is advised to study the compilation of responses to this survey for ideas.

Not all of the magnet schools reported come under the definition prescribed by the United States Department of Education to qualify for federal funds. But all of them provide an attractive, meaningful aviation education for students.

The survey tabulation consists of responses from eighteen (18) high schools. Each one is identified by name, address, person to contact and curriculum emphasis. The survey report assigns a number - 1 through 18 - for identification of the schools throughout the narrative.

The text of the survey follows. (Note: More space is allowed on the actual survey form for responses than is shown here.)

AVIATION MAGNET SCHOOL SURVEY

Name______________________ School ______________________

Program Characteristics

Year Program Was Established: _____
Number of Students in Your Program: ____ % Minority Students ____
Number of Faculty With Program: ____ % Minority Faculty ____
Number of Part Time Faculty: ____ Please list their teaching assignment:

Please Describe Any Trends in Enrollments:

Educational Level of Faculty:
PhD _____% Masters _____% Bachelors _____%

SURVEY

Aviation Training Background of Faculty: (Be Specific - Aviation Degrees and Aviation Ratings, Attach If Necessary)

Program Funding

Federal _____% State _____% Local Govt. _____%

Other Sources: Grants, Corporate Sponsors, etc.)

______________________________ _____%

______________________________ _____%

Program Organization

What are the formal objectives of your aviation magnet school? (Attach mission statement, if available)

What primary issues did you address in establishing the program? (Use space on back if necessary)

Curriculum

What is the emphasis of your curriculum? (Type of aviation and academic training)

What courses do your students take? (Attach curriculum and/or syllabus, if available)

What kinds of technological support is used to supplement your program? (List off-the-shelf audio-visual programs, computer aviation simulators, etc.)

Evaluation

What is the drop-out rate of students in the program?

What other program results are measured? (Please attach any written summary, if available)

Do you have a formal system for tracking your graduates? If so, how do you track them? (Please attach a summary of results, if available)

Resources

What government agencies or resources participate in your program?

How do they participate?

What kinds of support do your receive from local industry and business for the program?

If you have an outside advisory committee, please indicate representation.
If you have any formal program tie-ins with feeder schools or two- or four-year colleges in your region, please describe.

Please describe or attach any partnership work/study program used.

Community Awareness

What programs do you use to build and maintain community awareness?

Do you actively recruit minority students? If so, how?

What are the primary advantages your school offers the community?

AVIATION MAGNET SCHOOL SURVEY

1992-1993
OVERVIEW

This survey report is based on information compiled from eighteen magnet schools who responded to a survey request sent to 52 school district offices and specific secondary magnet schools. The contacts were taken from two lists totaling 119 magnet school grant contacts furnished by the U.S. Office of Education and a list of 48 school contacts furnished by the FAA as a result of their sponsorship of the first National Aviation Magnet School Conference held in Little Rock, Arkansas, in November, 1991.

An analysis of the returns indicates, as one respondent commented, that the term magnet is used somewhat generically since some states use the term to define special programs with special funding particularly regarding aviation programs. Therefore, this report counts a secondary aviation school as a magnet school if it draws students from throughout the district or city and is especially designed and funded to concentrate on aviation education applications.

The survey identified both new and long established programs with a general emphasis on responding to community and industry needs in the area of career education.

All programs surveyed appeared to be successful with low drop-out rates and stable or growing enrollments. Although program measurement and tracking systems widely varied from zero to fairly extensive, most schools utilized local industry and business for assistance. All schools used various government agencies for help with the FAA being the most frequently mentioned agency.

Most schools had local active advisory committees and specific tie-ins with feeder schools and colleges.

An emphasis in promoting community awareness in various ways, working on partnership and work/study programs and specifically recruiting minority students into the programs was also a common thread reported by the schools who responded.

Probably the most impressive reaction one has from reading the survey from each school is that the leadership in each program, whether teacher or administrator, appears to be highly pro-active and very involved in promoting the program to the students and the community.

KEY TO RESPONDENTS

1. South Mountain High School
   5401 South 7th Street
   Phoenix, AZ 85040

   Contact: Lewis Davis
   Curriculum: Aerospace magnet school, grades 9-12

2. Aviation High School
   36th Street & Queens Blvd.
   Long Island, NY 11101

   Contact: Dr. Eileen B. Taylor
   Primary Curriculum: Aviation high school

3. August Martin High School
   156-10 Baisley Blvd.
   Jamaica, NY 11434

   Contact: Leslie Gurka
   Curriculum: 4-year magnet school in aviation, communication, computer science, law

4. Washburn High School
   Minneapolis, MN 55409

   Contact: James Colby
   Curriculum: Aviation and aerospace magnet school, grades 9-12

5. Highland Springs Technical Center
15 South Oak Avenue
Highland Springs, VA 23075

Contact: Richard Upchurch
Curriculum: Aviation technician and pilot programs for grades 11-12

6. Catalina High School
3645 East Pima Street
Tucson, AZ 85716-3399

Contact: Robert L. Reynolds
Curriculum: Emerging aviation magnet program grades 9-12

7. East High School CAB/VOC/East
215 North First Avenue, East
Duluth, MN 55802

Contact: Jim Arndt
Curriculum: Aerospace technology, grades 11,12

8. Southside Center for Applied Technology
1784 Harrodsburg Road
Lexington, KY 40504

Contact: Wayne King
Curriculum: 2-year aviation technology program

9. Winston-Salem/Forsyth County Schools
P.O. Box 2513
Winston-Salem, NC 27102-2513

Contact: John Smoot
Curriculum: Aviation Technology course as part of vocational education program

10. Samuel F.B. Morris High School
6905 Skyline Drive
San Diego, CA 92114

Contact: John Shacklett
Curriculum: Aerospace magnet program for high school students

11. Suffolk Aviation Academy
2705 Smithtown Avenue
Ronkonkoma, NY 11779

Contact: Michael Weisz
Curriculum: Aircraft maintenance, pilot training

12. Westchester High School
7400 Manchester Avenue
Los Angeles, CA 90045

Contact: Ronald Keating
Curriculum: Math science aerospace magnet program for grades 9-12

13. William Fleming High School
3649 Ferncliff Avenue, NW
Roanoke, VA 24017

Contact: Tom Pearman
Curriculum: Aeronautical Science Technology, grades 6-12

14. Lakewood High School
Long Beach Unified School District
4400 Biercrest Avenue
Lakewood, CA 90714

Contact: Dean C. Gilbert
Curriculum: Aerospace technology magnet, grades 9-12

15. Walter F. George High School
800 Hutchens Road, S.E.
Atlanta, GA 30354

Contact: Jim Berto
Curriculum: Transportation magnet

16. Shawnee Aviation High School
4018 West Market Street
Louisville, KY 40212

Contact: Michael Rowland
Curriculum: Aviation careers

17. Delcastle Technical High School
1417 Newport Road
Wilmington, DE 19804

Contact: Albert E. Leonard
Curriculum: 4-year vocational technical school

SURVEY

18. Aviation High School
4101 North Marginal Road
Cleveland, OH 44114

Contact: Joseph Takacs
Curriculum: Aviation magnet school, grades 9-12

The foregoing aviation magnet schools responded to the survey and their responses are tabulated. The schools listed as 19-27 have been identified as aviation magnet schools. However, data on their surveys is not available in time for this publication.

Anyone planning an aviation magnet school program should feel free to communicate with any of the twenty-seven (27) listed schools.

19. Mr. Rick Deppe, Administrator
Special School District
12110 Clayton Road
Town and Country, MO 63131

20. Mr. Ron Snyder
Alternative School #1
11530-12th Avenue, NE
Seattle, WA 98125

21. Mr. Jerry Smith
Skyline High School
Career Development Center
Aeronautical Cluster
7777 Forney Road
Dallas, TX 75227

22. Ms. Essie Johnson
Alfred E. Beach High School
3001 Hopkins Street
Savannah, GA 31405

23. Mr. Eugene A. Santoro
Minuteman Regional Vo-Tech School
758 Marrett Road
Lexington, MA 02173

24. Mr. Harry Batty
Polytech High School
Kent County Vo-Tech School District
P.O. Box 97, Road 30
Woodside, DE 19880-0097

25. Mr. Robert S. Mullgardt
Science Department
Clayton High School
#1 Mark Twain Circle
Clayton, MO 63105-1613

26. Mr. Gardner Soule
Edison Tech & Occup. Educ. Center
655 Colfax Street
Rochester, NY 14606

27. Mr. Bradley Ports
Gateway Technology Institute
5101 McKee Avenue
St. Louis, MO 63110

PROGRAM CHARACTERISTICS

Schools initially responding to our survey ranged in age from the venerable Aviation High School established in 1936 in New York, to relative newcomer Catalina High School established this year in Arizona.

The largest school reporting was Aviation High School with 1900 students and 165 faculty; the next largest schools were South Mountain High School (336 students/6 faculty) and August Martin High School (450 students/5 faculty). The rest of the schools had around one hundred students or less and one or two faculty. Faculty educational levels were about evenly split between those holding masters and bachelors degrees.

All the schools reporting a trend indicated increased enrollments; with one school (Highland Springs Technical Center) noting that women enrolling had increased from 10% to 35%.

Most of the schools receive their funding from a combination of state and local sources. Two reported that they had received substantial state grants to start their programs and one started with federal grant money.

Key	Year Program Established	Number of Students	% Minority Students	Number of Faculty	% Minority Faculty	Part-Time Faculty	Key
1	1988	336	48%	6	33%	1	1
2	1936	1900	82%	165	27%	-0-	2
3	1971	450	96%	5	40%	-0-	3
4	1991	118	42%	4	-0-	3	4
5	1990	45	10%	2	-0-	2	5
6	1992	70	49%	1	---	---	6

SURVEY

7	1970	57	---	1	-0-	-0-	7
8	1990	27	22%	1	-0-	-0-	8
9	1976	26	16%	1	-0-	-0-	9
10	1978	85-100	50%	2	-0-	1	10
11	1975	120	20%	4	25%	-0-	11
12	1991	268	70%	11	40%	-0-	12
13	1987	32	25%	1	-0-	2	13
14	1989	480	63%	10	20%	-0-	14
15	1984	150	99%	3	66%	1	15
16	1989	325	39%	5	40%	-0-	16
17	1974	47	11%	1	-0-	-0-	17
18	1974	305	55%	24	35%	-0-	18

TRENDS IN ENROLLMENT

Key

1 Enrollment has doubled each year

3 Increase

5 Increase in females from 10% to 35%

8 Steady increase in students each year

10 Very stable; a few more females

11 Expect to increase 20% per year

12 Demand for this program has increased by double the number of applications over its first year

13 Enrollment continues to increase even though the course offerings have decreased

14 Because of shifting demographics in Long Beach, minority enrollment has dropped from the feeder middle schools. Increase in the number of magnet programs within the district has also decreased minority student enrollment.

15 Enrollment in the Diesel and Aviation components of the program has been less than expected. Efforts are being made, however, to familiarize students with the expanded career opportunities in these two areas. The recent addition of an experienced diesel technician to the staff has enhanced student interest in the diesel program and the addition of a "Pilot Ground School Course" to the curriculum through Opportunity Skyway has helped to increase enrollment in the aviation program.

16 Stable (increasing in count by 85 students/year)

18 Enrollment has been stable

EDUCATIONAL LEVEL OF FACULTY

PhD	Masters	Bachelors
1-17%	1-66%	1-17%
2-1%	2-45%	2-40%
	3-40%	3-60%
	4-43%	4-57%
	5-25%	5-50%
		8-100%
10-2%	10-65%	10-33%
	11-25%	11-25%
12-12.5%	12-37.5%	12-50%
		13-100%
	14-50%	14-100%
	16-60%	16-40%
	18-50%	18-50%

PROGRAM FUNDING

Federal	State	Local
		2-NYC Board of Ed.
	3-100%	
4-56%	4-22%	4-20%
	6-60%	6-40%
		7-100%
		8-95%
	9-20%	9-80%
	10-80%	10-20%
	12-80%	12-20%
		13-100%
14-60%	14-35%	14-5%
		15-100%
	16-15%	16-85%
	17-66%	17-34%
18-5.6%	18-47.5%	18-39.2%

Other Sources:

4-Minigasco Minigrant; Teacher Venture Grant
5-State grant of 60K to start program
6-State grants for equipment, software to start program
7-Local aviation organization
10-Magnet Assistance Grant; Carl Perkins Vocational Grant
12-United Airlines; Hughes Aircraft
13-Started with federal grant money for first two years; this year FAA grant
14-McDonnel-Douglas; Northrup; GTE

15-JTPA Grant for Opportunity Skyway
18-State loan at 7.7%

PROGRAM ORGANIZATION

When queried about the main issues addressed in establishing their programs, most schools emphasized a response to community/industry needs for technically skilled graduates.

Formal Objectives

Key

1 The mission of the aerospace program is for all students to gain the knowledge and confidence that will lead them into a career in the aerospace industry.

3 August Martin High School addresses the needs of its students, encourages success in the academics, nurturing individual differences, making available programs and resources ... so that [students] will develop a comprehensive range of abilities necessary for successful participation in our society.

4 Washburn is a caring student-centered, creative school committed to inclusive educational experiences which develop positive leaders, successful learners and active participants in a global community. [Objective:] To market the Aviation and Aerospace Magnet with an emphasis on recruiting students from minority groups and females, who are under-represented in the industry.

5 The Aviation Programs are designed to introduce students to aerospace and provide them with an opportunity to get an early start in one of two careers: Aviation Technician or Licensed Private Pilot.

8 The course was designed as an exploratory program into the aviation field. Emphasis, in the first year, is placed on a Private Pilot ground school, aircraft maintenance and exploring as many careers in aviation as possible. The second optional year is designed to give [students] a deeper look at one career.

10 To promote an integration program designed to relieve a minority isolated school.

12 To provide district resident senior high school students with a high quality academic program within an integrated setting.

13 To expose students to the many career opportunities in aviation and aviation-related fields. To orient the students with the real world of aviation through a ground and in-flight program as students work toward their private pilot license.

14 The mission of the Aerospace Technology Magnet is to insure that all participating students will be technologically literate, well-educated and better prepared to be responsible, productive members of the workforce. This mission will be attained through an articulated 2+2+2 curriculum in manufacturing technology, problem-solving applications integrating academic core components and career guidance.

15 Transportation was selected as George High School's "Magnet" theme because of its unique facilities and its proximity to the city's and the region's transportation hubs.

16 1) Motivate students to remain in school; 2) Improve academic performance; 3) Teach marketable skills.

17 The New Castle County Vocational Technical School District is committed to the development of competent, caring and productive members of a diverse and changing society through quality teaching, instructional technology and integrated curriculum.

18 [Respondent sent separate objectives statements for each program.]

PRIMARY ISSUES ADDRESSED IN ESTABLISHING PROGRAM

1 Minority students
2 Type of building and hangar, equipment, type of students, teachers with proper background, meeting all FAR 147 rules for certification
3 Community saw a need and through the Board of Education and with the aid of unions, airlines and educators, August Martin High School was established with an aviation theme
4 Significant shortage of skilled applicants for aviation and travel industry careers; recruit and prepare students who are members of disadvantaged and under-represented groups for careers in aviation and aerospace
5 Attached
6 Intend to provide vocational training that will feed into the aviation program at Pima Community College or Embry-Riddle in Prescott
7 Improve technical experience for students' career awareness opportunities

8 Industry needs; time available for student contact
9 At its inception, the Aviation Technology program was sponsored through a contractual agreement, by Piedmont Aerospace Institute (PAI). Under this arrangement the instructor was a PAI employee and the classes taught received FAA approval under the PAI certification. Career Center students entering PAI were given advanced standing upon successful completion of bypass tests. When PAI closed, the Career enter curriculum was modified to cover the North Carolina curriculum for Aerospace and to provide an exploratory course in aviation maintenance.
10 We wanted to provide an opportunity for hands-on training in the aeronautics field. We wanted this course to give students both the opportunity for entry level jobs as well as a strong foundation for aviation flying careers.
11 Curriculum, facility upgrades, flight training programs
12 To meet the general need to provide aerospace program
13 The increasing need for aviation professionals was apparent through the many studies reported in aviation periodicals
14 The ATM program was established to provide technical training for all students, with specific emphasis placed on the minority/high risk students
15 Each of the 16 magnet programs of the system is charged with offering students the unique opportunity to combine basic academic instruction with specialized career courses ... Transportation was selected as George High's magnet theme because of its unique facilities and its proximity to the city's and the region's transportation hub
16 Jefferson County's and President Bush's America 2000 Strategies for Choice in Public Schools
17 The present program was established around FAR 147 and the need of the local community

CURRICULUM

Curriculum at these schools emphasized meeting the academic requirements of their various states and at providing hands-on aviation training. Several include private pilot ground school as part of their program.

The most complete curriculum guide came from South Mountain High School.

Technological support varied. Most schools are using the Jeppesen Sanderson videotapes and slide programs. Several use simulators and computer simulators to enhance their courses.

Emphasis of Curriculum

1 Hands-on academic aviation training

2 Secondary academic mandated by New York City and New York State, FAR 147 school, follows mandate by FAA

3 Private pilot training, full academic preparation for college

4 Designed to be very general with emphasis on the wide variety of potential careers

5 Private pilot ground and flight instruction for FAA Certification, general courses toward FAA A & P rating

6 High tech academic training with hands-on vocational aerospace experiences

7 Aviation with simulation (GAT-1)

8 Exploratory into aviation careers, with emphasis on Private Pilot Ground School and Intro To Aircraft Maintenance

9 The curriculum is designed to allow students to explore as many of the various careers that fall under the large umbrella of aviation. Primary emphasis is given to the pilot and mechanic areas but guidance and counseling is provided for students interested in other industry-related areas

10 To prepare the student to get both the private pilot certificate and the instrument rating

11 Aviation Maintenance Airframe, Aviation Careers/Pilot Training

12 Math/Science

13 Students enroll in the 10th or 11th grade in ground school. Students with the FAA Private Pilot Written Exam passed enroll in Flight Training. Students carry the normal load of academic classes as well.

14 The core of the program focuses on computer education, with emphasis on technology as it applies to various subject disciplines

15 A 4-year program of study which combines academic and specialized career development/vocational education courses that the Center's students are provided a strong foundation upon which to build a successful career in the transportation industry

16 Aviation, Travel and Tourism

17 Aviation Maintenance (A & P)

18 Vocational courses are offered in four areas: aircraft maintenance/technician; avionics/electronics; aviation products marketing; air traffic control

Courses

1 [Respondent sent descriptions of eleven (11) aerospace-specific courses]

2 Airframe and Powerplant, Avionics and FCC license preparation

3 State requirements for academic high school diploma; aviation ground school; private pilot instruction by CFIs; technical drawing CAD hands-on shop activities

4 [Respondent sent nine (9) course descriptions

5 [Respondent sent two (2) brochures listing course prerequisites and descriptions

7 Aerospace I, Aerospace II, Simulator

8 [Respondent sent course objectives and competencies list]

9 Aviation Technology students study the following: Aviation History, Physics, Private Pilot Ground School, Airframe and Powerplant theory, systems and maintenance. The course is taught over a two-year, 720-hour span and far exceeds the state curriculum

10 [Respondent sent brochure of eleven (11) specialized courses]

11 FAR Part 147 Maintenance Airframe; FAR Part 61 Aviation Career/Pilot Training

12 Students take 4 years of Science (General Science, Biology, Chemistry, Physics); Math (Algebra 1A and up); English, Social Studies (World History, Geography, U.S. History, Government)

13 Ground School, Flight I, Flight II

14 [Respondent sent brochure listing 20+ specialized courses and description of 2+2+2 program (advanced college credit program)]

15 Five major courses of study, each with 60 credit hours of concentration during the junior and senior years: Aircraft Mechanics, Automotive Mechanics, Diesel Mechanics, Drafting and Electronics, Transportation Services, Marketing Education and Comprehensive Business Education

16 [Travel and Tourism, Flight Training, Avionics and Air Traffic Control courses]

17 [Aviation Mechanic Objectives and Course Description]

18 [Respondent sent catalog listing course curriculum]

Technological Support for Program

1 Frasca 141, Frasca 131, Jeppesen Sanderson Private Pilot Program, King Videotapes, FAA Tapes

3 Textbooks, flight simulator, wind tunnel, film strips, videos, flight safety bulletins

4 Jeppesen Sanderson videotapes and overhead transparencies for Aviation Fundamentals; Microsoft Flight Simulator 4.0 on 28 MacIntosh LC computers; Azuresoft ELITE Basic, SEL and JET IFR simulation software for 12 MacIntosh computers

5 Jeppesen Sanderson program slides, transparencies, videos, texts; FAA curriculum and equipment for technician program

7 GAT-1 Simulator, IBM Computer/Plotter using Aviation S/W; Aviation Software Technology Videos

8 ATC 610J Simulator, Cessna Pilot Center Training System, IAP Maintenance Videos, Microsoft Flight Simulator computer software
9 Jeppesen Sanderson's Aviation Fundamentals text, film strips and transparencies are used for the private pilot ground school portion of the course. The mechanics portion is taught from a combination of IAP and McGraw-Hill books
10 Cessna 172 aircraft; ATC 610 Simulator; Videotapes from Jeppesen; MacIntosh Classic Computer; Mock Wooden Airplane Control Panel; Large Demonstration Size Manual Flight Computer
11 IBM PS/2 Computers; ATC 610 Flight Simulators; Jeppesen/Sanderson Private Pilot Video Series
12 IBM PCs; Flight Simulators; Many technological modules
13 2 Beechcraft C-23 Sundowners; 2 IBM Computers; 1 Singer GAT-1-B Flight Trainer (Simulator); Audio-Visuals from Jeppesen-Sanderson
14 Microsoft Works, Microsoft Word, Claris CAD, CADCAM (Gibbs), VersaCAD, Superpaint, Hypercard, 3D CAD, Lego-Logo, Lego-Writer, Robotics, Optical Data Programs for Life and Physical Science
15 FAA materials; Jeppesen Sanderson "Aviation Fundamentals" texts, workbooks, texts, computer software, videos, etc.
16 Jeppesen-Sanderson books, AV, etc.;2 GAT-1 Flight Simulators
17 VCR programs and texts
18 Video training programs

EVALUATION

Most of the schools did not report a formal evaluation or tracking system for their graduates.

Probably the most impressive evaluation for these programs is the low drop-out rate. Most reported less than ten percent drop-out rates, with the average drop-out rate around 5%.

Drop-Out Rate

1 10%
2 6.9%
5 5%
6 7% at school; less than 3% at tech program
8 5%
9 8% to 10%
10 First year students: 25% drop within first seven weeks
60-65% return for second year
60% of second-year students return for third year
11 Approximately 10%
12 We are a new program - no dropouts or graduates yet

13 Over the past five years the dropout rate has been 0!
14 Approximately 4% (primarily due to attrition)
16 Less than 2%
17 0.5 % per year
18 89-90: 5%; 90-91: 8%; 91-92: 6%

Other Measures of Program Results

4 Students reflect the racial distribution in the district, however only 22% are female
8 FAA written exams
9 Program success is measured by the number of graduates who make their career decisions based on knowledge gained from participating in the aviation program. Not all of the students have the strong self-discipline necessary and some choose careers in other fields
10 Aeronautical knowledge measured by FAA administered Private Pilot Written Exam in their senior year. Flying ability evaluated by the instructor and if capable the student solos the aircraft. Instrument knowledge measured by tests in the classroom
11 Each student is required to take the FAA written and practical exam appropriate to their course of study
13 Students are informally tracked after graduation. Approximately 90% of our students continue with aviation related training
15 The magnet program follows the "Atlanta Public Schools Guidelines for Systemwide Magnet Program Operations" [additional information attached]
16 Post-secondary activity (i.e., college/university and employment)
17 Graduate follow-up studies to be resumed this winter (92-93)
18 [Respondent sent copy of 90-91 Building Profile filed with district, which is a standardized report of school objectives and achievements including student competencies]

System For Tracking Graduates

1 None
2 Guidance Department
6 IVEPs (Individual Vocational Education Plans)
8 Education and employment of graduates 1 year after leaving program
9 All course completers are tracked using the VEIS-6 (Vocation Education Information System) survey which is sent to all graduates twelve months after completion
10 Not a formal system, however the career tech and the magnet coordinator will ask for graduates to voluntarily return a survey

11 Formal tracking is a function of our school guidance department

16 As this is the fourth year of our program we have no formal graduates as yet. We intend to utilize six-month follow-up calls to determine activity of past graduates.

17 A graduate status board is kept on all graduates from 1974-75 to present giving credit for: 1) further education; 2) Military service; 3) Aviation Schooling; 4) Aviation Employment

RESOURCES

Not surprisingly, the single most-cited government resource used by these schools was the FAA. Many also relied on local Air National Guard for speakers, equipment and facilities. State Departments of Transportation were also used as resources.

Industry and business tie-ins ranged from service on advisory committees to co-op partnerships that combined jobs with earned school credit. One school has established a mentoring program with Allied Signal.

Most of the respondents were doing some type of tie-in with feeder schools and local colleges. Some promoted their schools by visits to local elementary and middle schools.

Government Agencies & Resources

1 FAA Designation as a Regional FAA Resource Center, Arizona Air National Guard: trains our A & P students using their staff and facilities

2 U.S. Military, FAA: speakers, equipment, training, jobs

3 FAA: donates equipment and materials; Tuskegee Institute: scholarships

4 MN Dept. of Transportation, Office of Aeronautics: videos, literature, resource people; FAA: videos, literature, resource people, field trip locations; Metropolitan Airports Commission: classroom space, resource people, field trip locations

5 FAA FSDO, RIC; VA Dept. of AVN; FAA ATC; FA Air National Guard; VA Army National Guard (Aviation); Richmond Airport Commission; National Weather Service; VA Aviation Museum; Each agency participates in internships of 20 hours for each student

6 Airesearch, Pima Community College, FAA, Air Force, Evergreen Air National Guard, Wright Flight, Tucson Medical Center

7 FAA, CAP, Duluth Air National Guard, Experimental Aircraft Association, FBOs

8 FAA, Class speakers and ATC co-op position

9 FAA: hosts field trips to ATC facilities and donated weather observation equipment; National Weather Service: hosts field trips
10 General Dynamics; Naval Air Depot: Morse High School and the Navy have developed an on-the-job training program in the repair of aircraft
11 FAA: Safety Seminars are conducted at our facility. Guest speakers participate in our classroom lectures
12 FAA: Provide speakers and instructional materials
13 FAA; Richmond FSDO: the local control tower participates by providing internships for our students; the FSDO office (Richmond) administers the Private Pilot Written exam to the ground school students
14 California Department of Education, Los Angeles County Office of Education: Awareness Programs
15 U.S. Department of Transportation (NHTSA); FAA; Metro Atlanta Rapid Transit Authority (MARTA); City of Atlanta Department of Aviation; Georgia Department of Education: Provide speakers, tours, summer internships, sponsorship of Summer ACE Academy, underwriting of JTPA Grant for Opportunity Skyway and by providing summer internships or co-op opportunities for students
16 FAA: grants, advisory committees, funding
17 FAA; Professional Aviation Maintenance Association (PAMA); Aviation Industry (Manufactures Product Support): materials, speakers, technical sessions plus handout information
18 FAA: monitor school and its programs to assure compliance with each pertinent section of FAR Part 147

Local Industry & Business

1 Allied Signal mentors all aerospace students
2 Aircraft manufacturers, airlines, general aviation operators: speakers, equipment, training, jobs
3 Career development and field trips; internships at JFK Airport
4 Northwest Airlines: resource people, mentors, airline passes, field trip locations; MN Aviation Trades Association: resource people, funding; Honeywell Corp: funding
5 Aero industries, Inc: Flight Instruction and Internships; Delta Airlines: Airline orientation visits for all students
7 Advisory, funding and equipment
8 Advisory committee; co-op partnership for field experience
9 Extensive partnership program
10 From time to time various industries and/or flying clubs will donate money to the program or offer flights for the students; General Dynamics - Scholarships, surplus materials
11 Business leaders serve on our aviation consultant committee

12 United Airlines and Hughes aircraft provide speakers, rewards, field trips, tutoring services, surplus equipment, tours, etc.

13 The Roanoke regional airport commission provides internship programs in airport management

14 Volunteers, financial support, external program training, work experience, advisory board, equipment upgrading

15 Delta Air Lines and Norfolk Southern Corporation provide speakers, tours, scholarship contributions, advisory committee representations, incentives, etc.

16 United Parcel Service, Delta Air Lines, Inc., SABRE American Airlines, Northwest Airlines, Travel Professionals International, Inc., TravelPlex, Embry Riddle Aeronautical University, Jefferson Community College, Derby Festival Committee, SKYCARE, Louisville Convention & Visitors Bureau, The Kroger Company, Winn-Dixie, Capital Holding, A.D. Porter and Sons, Citizens Fidelity, Shawnee Branch, Liberty National Bank & Trust Company of Louisville, Butler Aviation Louisville, Inc., Bowman Field Air Traffic Control Tower, Flight Services, Regional Airport Authority all support financially and/or in advisory capacities and/or through cooperative job or mentoring experiences

18 Local industry and business support varies over the years of the school's operation. Currently local businesses are looking favorably on assisting the school ... [A] letter [was] submitted to over 140 local business firms enlisting their assistance. Response to this letter has been very favorable.

Advisory Committee

1 Representatives of the industry: America West Airlines, Southwest Airlines, Allied-Signal, FAA, current FBO

2 Aircraft parts vendors, aircraft manufacturers, airlines, general aviation companies, FAA

3 FAA, NY State Education Office, Queens Borough President's Office, Queens Superintendent's Office, Queens Community Association, Port Authority

4 Augsburg College (NASA Space Grant College Consortium), Aviation Careers Unlimited, CAP, Flight Unlimited, MN Tech College, MN Youth Trust, MN Aviation Trades Association, MN Dept. of Transportation, FAA Northwest Airlines, Sauk Rapids High School, Negro Airmen International

5 US Air Airlines; VA Dept. of Aviation; Richmond Airport Commission; Air National Guard; FAA

6 Representative from organizations listed under "Resources" above; parents, students and faculty

7 Same as "Resources" listed above

8 FBO, ATC, Aviation History group, state government, 4-year college

9 The Career Center is served by a system-wide advisory committee made up of area business representatives
10 Naval Air Depot; General Dynamics
11 Major Airlines, Maintenance Overhaul Facilities, FAA, local Fixed Base Operators, Retired Aerospace Employees
13 FAA, Airport Management, Parents, Students, Fixed Base Operators
14 Northrup, McDonnel-Douglas, Rockwell and IMAR
15 Delta Air Lines, Inc., Norfolk Southern Corp., Conference of Minority Transportation Officials (MARTA), FAA
16 As listed for previous question
17 Very active - from various local businesses and professional organizations
18 There are numerous advisory committees operating. The total school has two such committees: The Magnet School Advisory Committee and the Industrial Advisory Committee. In addition, each vocational program has its own advisory committee designed along the same order as the magnet school committee.

Tie-Ins With Feeder Schools, Colleges

1 Current articulation with South Mountain Community College; working on articulation with feeder schools
2 All colleges with courses relating to aviation
3 SUNY Farmingdale: responsible for weekly flight instruction; Kennedy Airport: Career Day
4 Part of the MN Tech Prep Consortium; setting up tie-ins with Dunwoody Institutes and Minneapolis Tech College
5 Visit each middle and high school in county; elementary, middle and high school groups visit the technical center; Aviation technicians who finish general course may complete A & P program with Rice Aviation in one year
7 In process of articulation with 2-year and 4-year schools for transfer credit
8 Informal with 2-year A & P school and 4-year college pilot program
10 Keiller Middle School and Bell Junior High School work closely with our counselors and magnet coordinator in programming students into the aeronautic classes. We are currently working to implement a program to tie into the community colleges in our area
11 Dowling College offers up to 9 credit hours to students who successfully complete the 2-year Aviation/Careers program; The College of Aeronautics offers up to 36 credits for successful completion of the Aviation Maintenance Airframe program.
13 Our articulation program with Aeurett College (Danville, VA) provides college credit for our ground school and flight students.

14 Our program begins at 4 elementary sites in the fourth grade and continues throughout the middle and high school years. A student is able to earn a Bachelors Degree through a formalized contractual articulation program with Long Beach City College and California State University, Los Angeles

15 Georgia Institute of Technology - Partner in Opportunity Skyway Project; Clayton State College - Formal Partner in Education; Atlanta Area Tech - Formal Partner in Education - Feed students into Aviation Maintenance/Avionics Programs

16 Embry Riddle; Jefferson Community College; working on Eastern Kentucky University

18 A recruitment committee, staff and students, conducts presentations at all District Intermediate Schools to recruit interested students. All Cleveland Public school students are eligible to attend this or any other magnet school in the District. Additionally, a Schools of Choice night is held in the Spring. This is the magnet school fair held in the evening for all students and parents to distribute information about all magnet schools in the District.

Partnership Work/Study Programs

1 Mentoring program with Allied Signal

2 Support programs with airlines

3 FAA paid intern; JFK jobs (students earn minimum wage + school credit)

4 Finalizing a partnership between Washburn High School, Sauk Rapids High School, MN Dept. of Transportation and Northwest Airlines for work/study internships for seniors

5 See internships under resources

8 Have co-op with FBO, ATC, Flight School

9 Extensive partnership program with businesses

10 Naval Air Depot

11 At this time we have no formal work/study program in place. However, many of our students find part-time work here at Islip Airport

13 Internship program with air traffic control and airport management

14 Rockwell International and Northrup

15 USDOT/NHTSA hires co-op business education students; Delta Air Lines hires summer employees; City of Atlanta, MARTA and FAA places Opportunity Skyway "shadowing" students for summer/and regular school year program

16 Cooperative employment through local businesses

17 Students are afforded the opportunity to co-op (placed to work in a related job) their senior year if approved by their career program instructor on a two-week-about schedule (work two weeks - go to school two weeks)

COMMUNITY AWARENESS

Respondents used a variety of strategies to promote their programs in the community. Washburn High School attempts to get media coverage for school events ranging from helicopter landings on the football field to small hot-air balloon launchings. Many schools routinely provide programs to local civic clubs. One school promotes itself with a display at the local shopping mall.

Many schools emphatically recruit minorities. Highland Springs Technical Center uses a three-part strategy that includes:

1. Using minority role models in aviation industry to speak with middle and high school groups,
2. Encouraging minority students in program to invite their friends to classes and on flights, and
3. Including minorities in all publicity photos and brochures. Washburn High School works with the organization Negro Airmen International to spread the word about their program.

When asked about the primary advantages of the school to their community, Aviation High School summed it up best: "A student leaves us with a saleable skill and will become a credit to ANY community."

Programs to Build Community Awareness

2 Take part in many public functions

3 PTA; Aviation Day (community is invited)

4 Attempt to get media coverage: helicopters land on football field, launch water rockets made from 2-liter pop bottles, fly a hovercraft on the school grounds, launch small hot air balloons, fly radio-controlled aircraft, arrange for NASA space van and astronauts to speak at the school

5 Visits and presentations to PTA, Rotary, Kiwanis Clubs, Women's Clubs, radio and television presentations; newspaper articles

6 Participating in a locally broadcast television panel talk show on careers in aerospace in Tucson

7 Career Days, tours, visits and promotion

8 FAA Safety meetings, local history group, advisory committee, mall displays

9 Community awareness is maintained through Career Fairs at the systems middle schools; Tours of our facilities by elementary and middle school classes; community-wide open houses, the school channel on local cable TV

10 We have started a flying club called "The Flying Tigers." We make up T-shirts each year which are sold both to club members and to people throughout the school, the community and the airport. These often times create the opportunity to tell people about our program. More people are beginning

to realize that to learn to fly a student must learn and utilize knowledge in a wide variety of subjects, i.e., aerodynamics, math, meteorology, physics and human physiology

11 FAA Safety Seminars are held at this facility. This Aviation Academy sponsors an Open House activity at least once a year

12 Local radio/TV; local newspapers

13 Joint participation with the FAA in presenting safety seminars. Provide tours to groups from other school districts. Membership in the Virginia Aviation and Space Education Forum

14 PTA, Parent Booster Groups, High School and College Advisory Committees

15 Participates in the Mayor of Atlanta's Annual Dream Jamboree and the Annual Magnet Fair which highlights program for middle school students

16 Mailing of newsletters; media coverage; advisory committees; participatory management steering committee

17 Open House (to visit program and school); Visitation to middle schools to promote school and program; Summer visitation to prospective new students

18 Several district-wide publications that promote all the magnet schools in the District

Recruitment of Minorities

1 Recruiters from District level visit feeder schools

2 Visiting feeder schools

4 Use a brochure and videotape which show minority students and adults; Visit all junior high schools, middle schools and K-8 schools to recruit; Work with Negro Airmen International to spread the word about our program

5 YES! Use minority role models in aviation industry to speak with middle and high school groups; Use minority students in program to make contact with friends and invite to classes and on flights; Include minorities in all publicity photos and brochures

7 Visit sites and promote; use equity information

9 All courses at the Career Center are open to 11th or 12th grade students in the city-county system which comprises eight high schools. The Aviation Technology program averages 16-20% minority students

11 Students of all ethnic backgrounds are recruited through our school guidance department

12 School is 70% minority students; recruited through a district-wide publication

13 Yes - Guest speakers are invited to present "success stories" of the opportunities available to minorities in aviation; annual magnet recruiting fair

14 Yes. Each elementary site recruits their own students. Formal presentations are given at the feeder middle schools for contractual acceptance into the high school program

17 Our program has a population of 37% minority students and at Delcastle 35% of the students are minorities

18 All Cleveland public schools, in order to comply with the desegregation order, must reflect the district enrollment of minority students + /-15%. A quota system is used with students placed on a awaiting list to maintain this enrollment percentage

Primary Advantages of School to Community

1 A student with a quality high school diploma prepared to enter the workforce and/or post-secondary education

2 A student that leaves us with a saleable skill and will become a credit to any community

3 Students are prepared to fill positions at local airports

4 Washburn High School provides three high-quality programs (Aviation and Aerospace Magnet, International Studies Magnet and comprehensive school program); Community Education department provides night high school courses

5 Rare opportunity to get an early start on FAA Certification and an aviation career

7 Quality education, career opportunity; progress of P/S articulation

8 High school students have opportunities to explore the aviation field prior to leaving high school

9 Students are provided the opportunity to investigate and explore careers in aviation without the expenses normally associated with these areas. This allows students to make career decisions based on knowledge rather than [only] desire

10 A student has an opportunity to get a private pilot license for about $1500 compared to $4500. They will also save a tremendous amount on getting their instrument rating (one of the hardest in aviation). The program provides a headstart on a career in aviation. Top salaries now for airline captains are $235,000 a year (16 workdays a month). Combine this with virtually free travel benefits and I would say the students are becoming productive members of society in a profession they can truly enjoy

12 Strong academic program with small classes

13 Our program gives high school students from Roanoke City and surrounding counties the opportunity to learn to fly regardless of their financial circumstances. The orientation which our program provides to students allows

them to consider aviation-related fields which are not commonly recognized as attainable goals by most students

14 Students are given technical preparation through relevant computer systems and software

15 ... By encouraging students to develop competencies necessary for lifelong learning and to become effective workers and citizens, the Magnet's expectations are consistent with the total school's philosophy "to develop the individual to the limit of his/her capacity for complete living" ...

16 Practical applications for academic studies; An interesting and motivating program; A sound reason for students to remain in school and raise performance levels

17 Students in New Castle County are afforded the opportunity to apply to comprehensive vocational-technical high school training programs

18 Solid academic program in combination with outstanding technical training. Students are prepared for one of the many job opportunities in the aviation and aerospace industries or a two- or four-year college program

The above compilation represents incomplete data because not all respondents had reported at the time this publication went to press. However, the responses published here are representative of the total survey. For further information contact:

Mr. Frank G. Mitchell
Beech Aircraft Corporation
Aviation Education Department 198
9109 East Central
Wichita, KS 67201

"Aerospace technology magnets are making and must continue to make contributions ..."

Alicia Coro

SECTION XVI - SUGGESTIONS FOR FAA AVIATION EDUCATION COUNSELORS

The Federal Aviation Administration has established a new program to recruit, educate, train and use the many talents of volunteers to help in bringing aviation education to more young people and adults throughout the nation. These volunteers are known as FAA Aviation Education Counselors and they assist in helping to promote aviation education and in fostering a wider knowledge and deeper understanding of the FAA, the National Airspace System (NAS) and all facets of aviation in the United States and globally.

Counselors may be FAA employees or employees of an aviation company. Many counselors may be retired FAA or other aviation employees, teachers, interested parents, pilots or other aviation workers.

A key role of FAA Aviation Education Counselors is working with the educational systems of the country and especially helping teachers learn about the resources available to help students prepare for 21st century responsibilities.

A first step for anyone who wishes to become an FAA Aviation Education Counselor is to study the new FAA publication entitled: The Aviation Education Counselor Guide. It may be obtained from either the Aviation Education program staff in the Washington headquarters of FAA or by communicating with the appropriate FAA Regional Aviation Education Officer or Resource Center. Addresses are shown in the Resources Section of this publication.

Another important step for a counselor is to become familiar with the information in this publication. There are many examples of how one person or just a few people have influenced a local school in planning and carrying out a very meaningful aviation education program. In some cases, simply making a copy of this publication available to a teacher, principal, curriculum planner or interested parent, community or industry leader can be the catalyst to get a program started. However, a counselor should be fully familiar with what is included in this publication before giving a copy to someone else.

UNIQUE FEATURES OF EDUCATION IN THE UNITED STATES

To understand examples of what FAA Aviation Education Counselors should attempt to do, one must first insure that there is clear understanding of the nature and extent of education in the United States.

Education in the United States is unlike that in most other countries of the world. We do not have a national, centrally-directed, standardized system of education. We do have a diverse, pluralistic and local and state controlled system of education made up of both public and private or parochial institutions. This is true of elementary, secondary and college and university education.

One of the great strengths of education in the United States is the local autonomy that boards of education and boards of colleges and universities have to guide their own programs.

Factually, a local school - elementary, secondary or post-secondary - can do just about anything it wishes to do providing it does not violate a municipal, county, state or federal law.

Most states prescribe what local schools must do insofar as certification of teachers is concerned and they generally recommend minimum standards for graduation by stipulating the minimum number of credits required and the distribution of science, English and related studies that must be accomplished. However, in most states these requirements leave some latitude for local application or offering of electives or other courses, programs or activities. Most states also specify the minimum number of days that are required for the school to be open in order to meet their attendance standard. This standard is, frequently, that necessary to receive state financial support.

On the federal level, the primary regulatory role is to ensure that schools receiving federal funds meet the legal or statutory requirements for the funds. Most federal programs are in what is known as categorical aid. That is, the aid, funds or services provided are specified by the particular legislation enabling that special program or project. In recent years, the number of categorical programs administered by the United States Department of Education (USDE) has grown to nearly two hundred.

Except for a few specified areas, neither federal nor state laws require schools and colleges to comply with all of their mandates. There are some schools and colleges - by choice - that do not receive federal funds. Likewise, there are some schools and colleges that exercise their privilege of not accepting funds that are optional.

Most schools and colleges in the United States do fall under state and federal regulatory procedures of a variety of kinds. Those who are FAA Aviation Education Counselors need to realize that one of the first things an educator will ask is whether or not the particular aviation education project being discussed falls under the purview of FAA's regulatory responsibilities. A second question may be: does FAA provide funds for programs it is encouraging?

AVIATION EDUCATION PROGRAMS THAT MUST MEET FAA REGULATORY STANDARDS

What must an educator do if one wishes to start a program covered by FAA regulatory standards? The simplest way to answer an educator's question on this topic is by stating that any educational activity that attempts to train pilots, maintenance technicians and other airmen subject to FAA rule-making must, of course, meet the currently applicable Federal Aviation Regulations (FARs). For example, if a community college or high school decides it wants to offer a pilot training program or an aviation maintenance technician program the applicable regulations as to curriculum, written and practical tests and demonstrations of performance as prescribed by relevant FARs must be met.

There are many sources of help within FAA for educators planning such projects. In many cases, the relevant FARs will prescribe curriculum, areas of study, medical standards and other applicable requirements. In some instances FAA published material will include both written and practical test guides.

CHANNELS OF COMMUNICATION WITH EDUCATIONAL SYSTEMS

Aviation Education Counselors need to understand and follow accepted procedures of protocol when working with an educational system - public or private.

Educational systems - elementary, secondary and post-secondary - like any organized institutions have a system of appropriate communications with elements of the system with those outside the organization. For example, the question may arise: What procedure should one use to let educators know that you are an FAA Aviation Education Counselor and that you are available to provide some services to the local school or college? First, one must recognize that the head of an educational system wants to be aware of what is happening. Thus, in a town or city with several schools, one should go to the office of the superintendent, indicating what one is willing to do and ask to be referred to the appropriate person. If the system has several elementary schools, a high school and/or a vocational or technical high school the superintendent will generally make a referral to the appropriate school. In some instances it may be preferable to meet with a person or persons in the central office of the system to determine the nature and extent of the services FAA has available. In fact, FAA has materials, potential guest lecturers and resources that are applicable at all levels of education. The key point is to recognize that there are educational channels and make use of them.

In some instances, the local principal of the school may be the correct person with whom to start. This is especially true if one knows that the resources available are appropriate for that school.

In a college or university there are several options for communicating. First, one may go directly to the president and ask to be directed to the appropriate school, college or department within the institution (this assumes a large university). In a smaller college or community or junior college there are usually a number of divisions or departments. It is appropriate to go directly to the head of a given department if you believe your services will be useful in that particular segment of the institution.

FAA Counselors have many opportunities for very effective communication with schools via informal channels. For example, if you are a member of a Parent-Teacher Association (PTA) you will have excellent opportunities to let administrators and teachers know that you are a potential aviation education resource if the school is interested. Likewise, the children of FAA employees are encouraged to take relevant FAA aviation education materials to class to give to their teacher or - when appropriate - share with fellow students.

Quite often Counselors are members of a board of education or are trustees of a college or university. In such instances, there are opportunities to let the institution know of available FAA aviation education resources while staying within the accepted protocol of the institution.

The main point to keep in mind is that educational institutions at all levels, both public and private, welcome the offer of assistance providing it is done in a logical fashion.

TYPICAL REQUESTS FAA COUNSELORS MAY EXPECT FROM EDUCATORS AND SUGGESTED RESPONSES

When educators are aware that FAA is interested in aviation education and cooperative efforts that are appropriate to FAA's mission and resources, following are illustrative examples of requests and possible responses:

- How may I arrange for my students to visit a local FAA facility? The first thing to determine is the age and educational level of the students. Kindergarten or first and second grade youngsters, for example, may not be suitable for a tour of an Air Traffic Control Tower or Air Route Traffic Control Center (ARTCC). Whatever level of student that does visit, it should be made clear that sufficient adults are along to provide supervision of the students. Furthermore, efforts should be made to assure that students are prepared in advance of the visit by being briefed on what they will see, the role of the facility and the different types of work being performed. It is always helpful, too, to list terms, acronyms, specialized vocabulary that will be heard or observed during the visit. In brief, care should be taken that the age and experience level of those visiting are appropriate to assure maximum benefit from the experience.

- An elementary and/or secondary school administrator communicates with the nearest FAA Counselors and asks what resources FAA has to help them in areas such as: aviation materials, planning an aviation orientation or workshop for teachers, providing speakers on aviation topics or participating in a career conference for students and teachers.

Response to a request for materials may be readily handled by mailing a list of the aviation education materials available from FAA. Providing a speaker or speakers will require determining what the school's objective is and then coordinating a suitable person or persons. The most important thing to keep in mind is that a speaker can discuss his or her job and put that in the context of the total FAA mission.

It is important to realize that speakers performing this service are really role models for the audience. In career conferences, the key point is to let the audience know what you do and what other kinds of jobs there are in FAA and what preparation is either required or helpful.

Requests for planning an orientation or workshop-type experience for teachers is somewhat more complicated. First, determine the objectives the educational institution has for the project. Then determine how much time is available - several hours, several sessions of one or more hours' duration, etc. At this point, depending on the resources, experience level and time available of FAA personnel and Counselors, it may be prudent to call on additional local resources to be of assistance. Such resources may include a person from the Ninety-nines, Civil Air Patrol or other aviation-oriented organization or industry. In most instances, what the educators want is to learn more about various facets of aviation. FAA Counselors and personnel can provide this directly and coordinate additional expertise from other sources as needed.

- A local school administrator asks FAA: what might be done to plan a school-wide aviation education program? Such a request will require some discussion to determine what objectives the administrator has in mind and what resources are available within the school system. If it is determined that an extensive system-wide program is desired, the next best step may be to suggest the formation of an ad hoc planning, steering or advisory committee made up of representatives of the school system and various local aviation resources including FAA. Several meetings of such a committee will enable the local educators and aviation resource personnel to plan an appropriate approach that meets mutual objectives. A key point to keep in mind is that such a plan as described is the school's responsibility. FAA and others providing advice, assistance and technical expertise are performing an advisory role.

- The principal of a local vocational or technical high school or the head of an industrial arts department asks if FAA has any information on the possibilities of actually building an aircraft in school. How should such a request be answered?

The FAA, in cooperation with the Experimental Aircraft Association (EAA), has had many years of experience in what has come to be known as Project School Flight. This is a program where high school students work on the actual construction of an aircraft that will fly. Usually the aircraft is sold when it is completed and the funds are used to buy the materials with which to construct another aircraft. Students learn a variety of skills in such projects including:

- reading plans and specifications.
- working with various materials - metal, cloth, wood, plastic, composites.
- using a variety of tools.
- teamwork.
- working to close tolerances.

The FAA involvement in this educational program includes having an FAA maintenance inspector or designee come in to the school and actually inspect such things as welds, proper construction and installation of various aircraft and engine components. Thus, the aircraft that is completed must meet the approved plans and specifications and the workmanship must meet safety and structural standards of integrity.

The more than one-hundred high schools throughout the United States in which this program has successfully operated, are enthusiastic about the educational and career benefits. Students, teachers, administrators and parents are invariably high in their praise of this program.

SCIENCE, MATHEMATICS AND AVIATION-AEROSPACE EDUCATION

FAA employees and Counselors are fortunate in being active in a technological and scientific field that has such inherent interest for young and old alike. The subjects of science, mathematics and electronics relate directly to the mission of FAA.

Simply planning a flight requires considerable science and mathematic literacy. The study of weather phenomena, how and why an airplane flies, basic air navigation problems, weight and balance of an aircraft for safe flight all relate to disciplines that are not generally understood. Experience has shown that elementary and secondary students who may not otherwise be interested in science and mathematics soon discover that they must become knowledgeable in these areas if they are to successfully pursue their aviation interests, activities and possibly a career. Thus, students possess that basic motivation that enables them to learn things they might not otherwise be interested in studying.

Clearly, FAA Aviation Education Counselors have both a great challenge and an opportunity to be instrumental in helping young people and adults become much more aware of the nature and extent of the nation's aviation system. Furthermore, through their efforts there will be many more minorities and women who will discover that they, too, may aspire to and achieve a worthwhile career in aviation.

FAA Aviation Education Counselors are given opportunities for special workshop or training sessions to learn of the resources available, how best to work with educators and to learn about various elements of aviation and the National Air Space System.

Some Counselors will find it useful to offer to go into a classroom and do various demonstrations such as explaining the four forces of flight that show how and why an airplane flies. Others use some of the nearly one hundred simple but technically accurate aviation related experiments in the FAA publication entitled: Demonstration Aids for Aviation Education.

Still other Counselors visit schools and tell of their own career in aviation - how they got started, what they do (or did), what preparation one needs today to enter the same career and what it is like in the aviation world of work.

FAA Aviation Education Counselors will have opportunities to meet at local, regional and national sessions to exchange ideas and discuss how various requests for aviation education help were handled. Counselors should plan on attending the annual National Congress on Aviation and Space Education (NCASE) or the annual national conference on aerospace magnet schools to learn of the latest developments in schools and colleges across the nation.

FAA Aviation Education Counselors know they are making outstanding contributions to helping educate the citizens and aviation leaders of the 21st century. They also enjoy helping the next generation learn about the aviation heritage on which our continuing aviation leadership in the world depends.

SECTION XVII - RESOURCES FOR PLANNING AND CONDUCTING AVIATION - SPACE - TRANSPORTATION MAGNET PROGRAMS

Since man's first efforts to fly there have been students and teachers interested in learning more about aviation and the resulting forces that influence society.

Innovative teachers and highly motivated students learned to use aviation both as a subject of study and as a tool to facilitate learning. In the beginning there were very few resources available to teachers. They had to design and create their own. As of 1993, there are many resources available for any student, teacher, administrator, volunteer who wants to learn about aviation, aerospace, transportation and the educational implications of these technical and scientific developments.

In this section, there is a listing of some of the sources of information, teaching materials and resources for those interested in planning and conducting aviation and related educational magnet activities , projects, programs or courses at all levels of education. These resources include government agencies, industries, industry organizations, private organizations, volunteer organizations and special groups devoted to aviation and space.

Today there are more resources available to further aviation, space, transportation education programs than at any time in history other than during World War II when huge resources of education and training were made available to focus on winning the war. In 1993, there is a different war facing the nation. It is a war against ignorance, poverty, racial and ethnic segregation and isolation and teen-age unemployment. Magnet school programs have demonstrated the capability of dealing successfully with some of these problems.

The resources described in this section do not represent all such potentials for providing help to educators. They are illustrative of such support available either free or at low or reasonable cost.

Among the greatest resources are the thousands of volunteers who are ready, willing and able to be of help if asked.

Any school system in the country can marshal the resources to plan and carry out an aviation magnet program by calling on some of the sources of help identified in this section.

U.S. DEPARTMENT OF TRANSPORTATION (DOT) - FEDERAL AVIATION ADMINISTRATION (FAA) RESOURCES

FAA AVIATION EDUCATION REPRESENTATIVES:

In the Washington headquarters of FAA there are Aviation Education Specialists. In each FAA Region as well as at the FAA Aeronautical Center in Oklahoma City, Oklahoma and the Technical Center in Atlantic City, New Jersey there is a person designated to provide technical advice relating to aviation education. In order to determine which Regional Aviation Education Representatives one should request help from, the following listing should be consulted to determine which states the FAA Regional Representative serves.

Dept. of Transportation/FAA
Phillip S. Woodruff, AHT-100
Director of Aviation Education
Headquarters
Aviation Education Division
Mary Jo Byberg
Charles Pagnini
Latisha Ferguson
DOT/NASSIF, Room PL-100
Office of Training & Higher Educ.
400 7th Street, SW
Washington, D.C. 20590
(202) 366-7500

Aeronautical Center
Robert Hoppers, AAC-5
Room 356, Headquarters Bldg.
P.O. Box 25082
Oklahoma City, OK 73125
(405) 680-7500

Technical Center
Michele Pareene, ACM-100
Atlantic City International Airport
Human Resource
Management Division
Atlantic City, NJ 08405
(609) 485-6032

Alaskan Region
Mary Lou Wojtalik, AAL-5B
222 West 7th AVenue, Box 14
Anchorage, AK 99513-7587
(907) 271-5293

Central Region
Patrice Shalda, ACE-5
601 East 12th Street
Federal Building, Room 1501
Kansas City, MO 64106
(816) 426-5836
STATES: Iowa, Kansas, Missouri and Nebraska

Eastern Region
Jim Szakary, AEA-17
JFK International Airport
Federal Building #111
Jamaica, NY 11430
(718) 553-1056
STATES: Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, Virginia and West Virginia

Great Lakes Region
Lee Carlson, AGL-5A
O'Hare Lake Office Center
2300 East Devon Avenue
Des Plaines, IL 60018
(312) 694-7042
STATES: Illinois, Indiana, Michigan, Minnesota, North Dakota, Ohio, South Dakota and Wisconsin

New England
Shelia Bauer, ANE-8
12 New England Executive Park
Burlington, MA 01803
(617) 273-7064
STATES: Connecticut, Maine, New Hampshire, Rhode Island, Vermont and Massachusetts

Northwest Mountain Region
Shelly McGillivary, ANM-5E
1601 Lind Avenue, SW
Renton, WA 98055
(206) 227-2804
STATES: Colorado, Idaho, Montana, Oregon, Utah, Washington and Wyoming

Southern Region
Joe Sidney, ASO-17.4
3400 Norman Berry Drive
East Point, GA 30344
(404) 763-7500
STATES: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Puerto Rico and the Virgin Islands

Southwest Region
Debra Myers, ASW-5
4400 Blue Mound Road
Ft. Worth, TX 76193-0005
(817) 624-5804
STATES: Arkansas, Louisiana, New Mexico, Oklahoma and Texas

Western-Pacific Region
Hank Verbais, AWP-5
P.O. Box 92007
Worldway Postal Center
Los Angeles, CA 90009
(310) 297-1431
STATES: Arizona, California, Nevada and Hawaii

FAA AVIATION EDUCATION RESOURCE CENTERS (AERCs):

FAA AERCs are established at colleges and universities, museums and other locations to provide a focal point for resources including aviation education programs, publications, software and videotapes. These centers are repositories of materials and distribution centers. They are designed for students, teachers and researchers and they provide materials to enhance aviation education. New AERCs are added by FAA from time to time. The following list is based on the information available in mid-1993. The latest list of AERCs may be obtained from your FAA Regional Aviation Education Representative.

Alabama
Alabama Aviation Technical College
Ms. Megan Johnson, Director
Learning Resource Center
P.O. Box 1209
Ozark, AL 36361
(205) 774-5113

University of North Alabama
Ms. Michele R. Walker
Programming Coordinator
UNA Box 5145
FLorence, AL 35632-0001
(205) 760-4623

University Aviation Association
Mr. Gary W. Kiteley, Executive Director
3410 Skyway Drive
Opelika, AL 36801
(205) 844-2434

Alaska
University of Alaska Fairbanks
Mr. Dennis Stephens
Collection Development Officer
Elmer E. Rasmuson Library
Fairbanks, AK 99775-1006
(907) 474-6695

Alaska Pacific University
Dr. Rusty Myers, Project Director
4101 University
Anchorage, AK 99508
(907) 564-8207

University of Alaska Anchorage
Ms. Barbara Sokolov
Library Director
3211 Providence Drive
Anchorage, AK 99508
(907) 786-1825

Arizona
Embry-Riddle Aeronautical University
Ms. Karen Hudson
Educational Programs Coordinator
3200 N. Willow Creek Road
Prescott, AZ 86301
(602) 771-6673

South Mountain High School
Mr. Lew Davis, Program Manager
Center for Aerospace Education
5401 S. 7th Street
Phoeniz, AZ 85040
(602) 271-3439

Pima Community College
Mr. Tony Gulielmino
Aviatino Department Chair
1668 South Research Loop Road
Tucson, AZ 85730
(602) 884-6186

Flandrau Science Center
Mr. Gilbert McLaughlin
University of Arizona
Tucson, AZ 85721
(602) 621-4515

Arkansas
Crowley's Ridge Education Service Coop.
Mr. Louis Midkiff
P.O. Box 377
Harrisburg, AR 72432
(501) 578-5426

California
Apple Valley Science & Tech Center
Mr. Rick Piercy, Coordinator
P.O. Box 2968, 15552 Wichita
Apple Valley, CA 92307
(619) 242-3514

National University
Mr. Ernest Wendt, Chairman
Department of Applied Sciences
4141 Camino Del Rio South
San Diego, CA 92108
(619) 563-7122

San Jose State University
Mr. Nick Milichevich, Chairman
Department of Aviation
1 Washington Square
San Jose, CA 95192-0081
(408) 924-6580

Museum of Flying
Mr. Harvey Ferer
2772 Donald Douglas Loop N.
Santa Monica, CA 90405
(310) 392-8822

San Bernardino Co. Supt. of Schools
Ms. Nancy Harlan, Coordinator
Instructional Services Division
601 North E. Street
San Bernardino, CA 92410-3093
(714) 387-3152

Riverside County Office Of Education
Ms. Mary Ann Liette, Coord. of ERC
3939-13th Street
Riverside, CA 92502-0868
(909) 788-6684

Colorado
U.S. Space Foundation
Dr. Jerry Brown
Educational Director
1525 Vapor Trail
Colorado Springs, CO 80916
(719) 550-1000

Metropolitan State College of Denver
Mr. Jonathan R. Burke
Assistant Professor
Aerospace Science Department
Campus Box 30
P.O. Box 173362
Denver, Co 80217-3362
(303) 556-2923

Connecticut
Connecticut DOT
Bureau of Aviation and Ports
Ms. Andre J. Libert
Director of Marketing for Aviation
24 Wolcott Hill Road
P.O. Drawer A
Wethersfield, CT 06129
(203) 566-4417

Delaware
Delaware Teachers Center
Ms. Stephanie Wright
Claymont Education Campus
3401 Green Street
Claymont, DE 19703
(302) 798-3806

Florida
Embry-Riddle Aeronautical University
Ms. Patricia Fleener-Ryan
AvEd Tteacher Resource Center
Daytona Beach, FL 32114
(904) 226-6499

Florida Institute of Technology
Dr. Ballard M. Barker, Head
Department of Aviation Studies
The School of Aeronautics
150 West University Boulevard
Melbourne, FL 32901-6988
(407) 768-8000 Ext. 8120

Florida Memorial College
Mr. Anthony J. Sharp, Director
Division of Airway Science
15800 Northwest 42 Avenue
Miami, FL 33054
(305) 623-1440

Georgia
Conyers Middle School
Ms. Viki Dennard
Assistant Principal
335 Sigman Road
Conyers, GA 30207-3699
(404) 483-3371

Museum of Aviation at Robins AFB
Ms. Joyce Carlton
Director of Education
P.O. Box 2469
Warner Robins, GA 31099
(912) 926-4242

Hawaii
Mid-Pacific Institute
Dr. Phillip R. Brieske
Aviation/Space Science
2445 Kaala Street
Honolulu, HI 96822
(808) 973-5000

State of Hawaii
Department of Transportation
Mr. Rodney M. Kuba
Airports Division
Honolulu International Airport
Gate 29, EWA Service Court Road
Honolulu, HI 96819-1898
(808) 836-6542

Idaho
Idaho State Bureau of Aeronautics
Mr. John Maakestad
Safety/Information Officer Chief Pilot
3483 Rickenbacker Street
Boise, ID 83705-5018
(208) 334-8775

Illinois
Parks College of St. Louis University
Dr. Peggy Baty
Associate Vice President and Dean
500 Falling Springs Road
Cahokia, IL 62206
(618) 337-7500

Southern Illinois University
Dr. Elain Vitello
College of Technical Careers
Room 222
Carbondale, IL 62901
(618) 453-8821

State of Illinois
Division of Aeronautics
Mr. Richard M. Ware
One Langhorne Bond Drive
Capital Airport
Springfield, IL 62707-8415
(217) 785-8516

Iowa
The University of Northern Iowa
Ms. Julie Wilkinson
IRTS
222 Schindler Education Center
Cedar Falls, IA 50614-0610
(319) 273-2717

Kansas
Hutchinson Community College
Mr. Edward E. Berger, President
1300 N. Plum
Hutchinson, KS 67501
(316) 665-3505

Kansas State University-Salina
Ms. Karlene Propst
Tullis LIbrary
2408 Scanlan Avenue
Salina, KS 67401
(913) 825-0275

Louisiana
Louisiana State University
Dr. Marlon Abbas, Director
Transportation Systems Group
Louisiana Trans. Research Center
4101 Gourrier Avenue
Baton Rouge, LA 70808
(504) 767-9127

Northeast Louisiana University
Mr. Ernie Bruce
Room 103
Chemistry & Natural Sciences Building
MOnroe, LA 71209-0590
(318) 342-1784

BEST COPY AVAILABLE

Maine
Kennebec Valley Tech. College
Ms. Sue Doner
92 Western Avenue
Fairfield, ME 04937-0020
(207) 453-9762

Biddeford School Department
Ms. Sara Jane Poli
Maplewood Avenue
Biddeford, ME 04005
(207) 282-8280

Penobscot Nation Tribal Admin.
Mr. Mark Sanborn, Asst. Director
Vocational Training & Education
6 River Road, Community Bldg.
Indian Island, ME 04468
(207) 827-7776

Northern Maine Technical Center
Mr. Timothy D. Crowley
Dean of Students
33 Edgemont Drive
Presque Isle, ME 04769
(207) 769-2461

Massachusetts
Bridgewater State College
Mr. Bill Annesley
Management Science & Aviation Science
Department
Bridgeport, MA 02325
(508) 697-1395

North Shore Community College
Dr. Robert Finklestein
One Ferncroft Road
Danvers, MA 01923
(508) 762-4000 Ext. 6296

Museum of Science
Ms. Carolyn Kirdahy
Lyman Library
Science Park
Boston, MA 02114-1099
(617) 589-0266

Lexington Public School System
Dr. Nicholas Tzimopoulos, Director
Curriculum/Science Education
1557 Massachusetts Avenue
Lexington, MA 02173
(617) 861-2484

Westfield State College
Ms. Maureen McCartney
Director of Career Services
Ely Campus Center
Western Avenue
Westfield, MA 01086
(413) 568-3311 Ext. 206

Massachusetts Aero. Commission
Dr. Roby Penstlen
Transportation Library
10 Park Plaza
Boston, MA 02116-3966
(617) 973-8000

Michigan
Oakland University
Ms. Karen Conrad
Interim Director
Aviation & Space Center
216 O'Dowd Hall, Room 216
Rochester, MI 48309-4401
(313) 370-2485

Project STARS
Ms. Barbara Kosak
Box 450082, Building 814
Selfridge ANG Base, MI 48045
(313) 466-4884

Minnesota
Minnesota DOT Office Of Aeronautics
Mr. Gordon Hoff, Director
Aviation Education Relations
222 East Plato Boulevard
St. Paul, MN 55107-1618
(612) 297-7652

Vermilion Community College
Mr. Julius Salinas
Aviation Director
1900 E Camp Street
Ely, MN 55731
(218) 365-7200

Mississippi
Jackson State University
Dr. Harry A. Cooley, Director
Airway Science Program
1400 Lynch Street
Jackson, MS 39217
(601) 968-2471

Stringer Aerospace Education Center
Mr. Mark Rice
P.O. Box 68, Old Highway 15
Stringer, MS 39481
(601) 649-5566

MONTANA
Montana DOT
Aeronautics Division
Mr. Michael D. Ferguson
P.O. Box 5178
Helena, MT 59601
(406) 444-2506

Nebraska
University of Nebraska
Dr. Brent Bowen, Director
Aviation Institute
60th and Dodge
Omaha, NE 68182-0508
(402) 554-3424

Nebraska Dept. of Aeronautics
Mr. Val J. Hruska
Aviation Specialist
P.O. Box 82088
Lincoln, NE 68501-2088
(402) 471-2371

New Hampshire
New Hampshire DOT
Division of Aeronautics
Mr. Ronald Wanner
65 Airport Road
Concord Municipal Airport
Concord, NH 03301-5298
(603) 271-2551

Daniel Webster College
Ms. Hanna McCarthy, PResident
20 University Drive
Nashua, NH 03063-1699
(603) 883-3556

Nevada
Frankie Lukasko
Galena High School Community Library
3600 Butch Cassidy Way
Reno, NV 89511
(702) 851-5630

New Mexico
University of New Mexico
Mr. Richard S. Sanchez, Director
FAA/NASA Teacher Resource Center
Division of Continuing Education
Albuquerque, NM 87131-4006
(505) 277-2631

New Mexico State University
Ms. Judy McShannon
Room 103, Goddard Hall
Las Cruces, NM 88003-0001
(505) 646-6414

New Jersey
Northeast Curriculum Coord. Center
Dr. Martha Posci
Division of Vocational Education
Crest Way
Aberdeen, NJ 07747
(908) 290-1900

Atlantic Community College
Mr. Paul Rigby
5100 Black Horse Pike
Mays Landing, NJ 08330
(609) 343-5113

New York
Dowling College
Dr. Albert E. Donor
Provost, Executive Vice President
Oakdale Long Island, NY 11769
(516) 244-3200

North Dakota
University of North Dakota
Mr. Charles L. Robertson
Assistant Professor
Department of Aviation
Box 8216, University Station
Grand Forks, ND 58202-8216
(701) 777-2791

Ohio
Bowling Green State University
Mr. Stephen M. Quilty, A.A.E.
Assistant Professor
Aerotechnology Program
Technology Annex
Bowling Green, OH 43403-0307
(419) 372-8926

Oklahoma
University of Oklahoma
Dr. Lee Morris, Director
Education & Aviation/Aerospace
1700 Asp Avenue
Norman, OK 73037-0001
(405) 325-1964

Rhode Island
Warwick Public Schools
Mr. Anthony Gagliardi
Warwick Career & Tech School
575 Centerville Road
Warwick, RI 02886
(401) 737-3300

South Dakota
Sisseton Wahpeton Comm. College
Mr. Chip Harris, Director
Office of Planning and Development
Old Agency Box 689
Sisseton, SD 57262-0689
(605) 698-3966

Tennessee
Middle Tennessee State University
Dr. Wallace R. Maples, Chairman
Aerospace Department
East Main Street
P.O. Box 67 MTSU
Murfreesboro, TN 37132
(615) 898-2788

Texas
Texas Southern University
Mr. Isaac Nettey, Director
Airway Science Program
3100 Cleburne Avenue
Houston, TX 77004
(713) 639-1847

University of Texas at El Paso
Dr. Jim Milson, Chairman
Room 403, Education Building
El Paso, TX 79968-0574
(915) 747-5426

Texas State Technical College
Campus LIbrarian
Aerospace Technologies
3801 Campus Drive
Waco, TX 78708
(817) 799-3611

Palo Alto College
Mr. Bruce Hoover
Aviation Department
1400 West Villarette
San Antonio, TX 78224
(512) 921-5162

Frontiers of Flight Museum
Mr. Olin Lancaster, Director
Love Field Terminal, BL-38
Dallas, TX 75235
(214) 350-3600

Utah
Utah Valley Community College
Dr. P.R. "Ron" Smart
Director, Aviation Science Dept.
800 West 1200 South
Orem, Utah 84058
(801) 222-8000

Vermont
St. Johnsbury Academy
Mr. John Barney
Vocational Director
St. Johnsbury, VT 05816
(802) 748-8171

Virginia
Virginia Aviation Museum
Ms. Betty P. Wilson
5701 Huntsman Road
Sandston, VA 23150-1946
(804) 786-1364

Washington
Museum of Flight
Mr. Gregory Moyce
Education Program Manager
9404 East Marginal Way South
Seattle, WA 98108
(206) 764-5700

West Virginia
Salem-Teikyo University
Dr. Ronald Ohl, President
223 West Main Street
Salem, WV 26426
(304) 782-5234

Wisconsin
Experimental Aircraft Association
Mr. Chuck Larsen
EAA Aviation Center
3000 Poberezny Road
Oshkosh, WI 54903-3065
(414) 426-4800

Department of Transportation
Bureau of Aeronautics
Mr. Duane Esse
4802 Sheboygan Avenue
P.O. Box 7914
Madison, WI 53707-7914
(608) 266-3351

University of Wisconsin-Superior
Mr. Michael J. Wallschlaeger
Chairman
Division of Education
1800 Grand AVenue
Superior, WI 54880-2898
(715) 394-8309

Wyoming
Campbell County School District
Media Services
Ms. Jan Burke
1000 W. 8th Street
Gillette, WY 82716
(307) 682-2225

FAA AIRWAY SCIENCE RECOGNIZED INSTITUTIONS:

These colleges and universities are potential sources of aviation technical advice. They are listed below.

Arizona State University
Dr. Laurence E. Gesell
Dept. of Aeronautical Technology
Tempe, AZ 85287
(602) 965-7775

Auburn University
Mr. Emmett F. Johnson
Aerospace Engineering
162 Wilmore Lab
Auburn University, Al 36849
(205) 844-6848

Averett College
Mr. David Ruev
Assistant Professor of Aviation
420 West Main Street
Danville, VA 24541
(804) 791-5615

Baylor University
Dr. Max Shauck
Project Chairman
P.O. Box 97440
Waco, TX 76798-7440
(817) 848-5050

Bridgewater State College
Mr. William L. Anneseley
Aviation Science Coordinator
Bridgewater, MA 02325
(617) 697-1395

Central Missouri State University
Dr. Tim Brady, Chair
Dept. of Power & Transportation
Technology Complex 210
Warrensburg, MO 64093
(816) 543-4975

Central Washington University
Dr. Robert M. Envick
Industrial & Engineering Technology
Hebeler 101
Ellensburg, WA 98926
(509) 963-3691

Chadron State College
Dr. M.L. Gramberg
Div.of Vocational & Tech. Education
Chadron, NE 69337
(308) 432-6365

Daniel Webster College
Mr. Thomas Teller
Airway Science Coordinator
20 University Drive
Nashua, NH 03063
(603) 883-3556

Delaware State College
Dr. Pamela McDermott
Chair, Airway Science Department
1200 North DuPont Highwasy
Dover, DE 19901
(302) 739-3535

Delta State University
Mr. Robert H. Ryder
Commercial Aviation
Box 3203
Cleveland, MS 39833
(601) 846-4206

Dowling College
Dr. Paul Whelan
Dean, School of Aviation & Transportation
Idle Hour Boulevard
Oakdale, NY 11769
(516) 244-3077

Edward Waters College
Dr. Gretchen Lockette
Business Administration Division
1658 Kings Road
Jacksonville, FL 32209
(904) 366-2739

Elizabeth City State University
Mr. William Barker
Director, Airway Science Program
ECSU Box 823
Elizabeth City, NC 27909
(919) 335-3290

Embry-Riddle Aeronautical University FL
Dean William A. Martin
College of Aviation Technology
600 South Clyde Morris Boulevard
Daytona Beach, FL 32114-3900
(904) 226-6215

Embry-Riddle Aeronautical University
Prescott
Mr. Pete Halley
Department Chairman, Aero. Science
3200 N. Willow Creek Road
Prescott, AZ 86301
(602) 776-3856

Florida Institute of Technology
Mr. Alan Devereaux
School of Aeronautics
150 W. University Boulevard
Melbourne, FL 32901
(407) 768-8000

Florida Memorial College
Mr. J. Anthony Sharp
Director, Airway & Computer Science
15800 Northwest 42nd Avenue
Miami, FL 33054
(305) 623-4277

Hampton University
Mr. Garry C. Jerome
Department of Airway Science
Hampton, VA 23668
(804) 727-5417

Henderson State University
Dr. Jerry L. Robinson
Director of Aviation Programs
HSU Box 7611
Arkadelphia, AR 71923
(501) 246-5511

InterAmerican University of Puerto Rico
Dr. Eleazar Lamboy
Coordinator, Airway Science Program
Metropolitan Campus, Box 1293
San Juan, PR 00919-1293
(809) 250-1912

Jackson State University
Dr. Raphel Lee
Chair, Dept. of Tech. & Indus. Arts
1400 John R. Lynch Street
Jackson, MS 39217
(601) 968-2466

Kent State University
Mr. Lynn C. Feterle
Director, Kent State Airport
4020 Kent Road
Stow, Ohio 44224
(216) 672-2640

Lewis University
Mr. Humphrey Abeh
Assistant Professor of Aviation
Route 53, Box 282
Romeoville, IL 60441
(815) 838-0500

Louisiana Tech University
Prof. Richard J. Ozment
Dept. of Professional Aviation
P.O. Box 3181 Tech Station
Ruston, LA 71272-9989
(318) 257-2691

Metropolitan St. College of Denver
Mr. Robert Mock
Chair, Aerospace Science Dept.
P.O. Box 173362, Campus Box 30
Denver, CO 80217-3362
(303) 556-2982

Middle Tennessee State University
Dr. Wallace R. Maples
Chair, Dept. of Aerospace
Box 67
Murfreesboro, TN 37132
(615) 898-2788

Morris Brown College
Mr. Floyd Campbell
Dept. of Computer Science
643 Martin Luther King, Jr. Drive SW
Atlanta, GA 30314
(404) 220-0159

National University
Mr. Earnest Wendt
School of Tech. & Computer Science
4141 Camino del Rio South
San Diego, CA 92108
(619) 563-7355

Norfolk State University
Mr. Darryl Stubbs
Computer Science Department
2401 Corprew Avenue
Norfolk, VA 23504
(804) 683-9447

Northeast Louisiana University
Mr. William T. Hemphill
Department of Aviation
Monroe, LA 71209
(318) 342-1780

Ohio University
Ms. Joan E. Mace
Chairperson, Aviation Department
Athens, OH 45701
(614) 698-2028

Oklahoma State University
Mr. Glen Nemecek
Coordinator, Aviation Education
300 North Cordell
Stillwater, OK 74078-0422
(405) 744-5856

Parks College of St. Louis University
Dr. Peggy Baty
Associate Vice President and Dean
St. Louis University
Cahokia, IL 62206
(618) 337-7500

Purdue University
Dr. William P. Duncan
Department of Aviation Technology
West Lafayette, IN 47906
(317) 494-9950

Rocky Mountain College
Mr. David G. Kimball
Director of Aviation Studies
1511 Poly Drive
Billings, MT 59102
(406) 657-1060

San Jose State University
Prof. Nick Milichevich
Department of Aviation
One Washington Square
San Jose, CA 95192-0081
(408) 924-6582

So. Illinois Univ. at Carbondale
Dr. David A. NewMyer
Coordinator, Aviation Mgt. & AWS
Carbondale, Il 62901
(618) 453-8898

St. Cloud State University
Dr. Hope B. Thornberg
Department of Technology
HH 101-SCSU
St. Cloud, MN 56301
(612) 255-4167

St. Francis College
Professor Stanley G. Maratos
Chair, Aviation Management
180 Remsen Street
Brooklyn, NY 11201
(718) 522-2300

Suffolk University
Dr. John L. Sullivan
Coordinator, Aviation Programs
8 Ashburton Place
Boston, MA 02108
(617) 723-4700

Tennessee State University
Mr. T. Ledwith
AIT Acting Department Head
3500 John Merrit Boulevard
Nashville, TN 37209-1561
(615) 320-3287

Texas Southern University
Prof. I. Richmond Nettey
Director, Airway Science
3100 Cleburne Avenue
Houston, TX 77004
(713) 639-1847

The Ohio State University
William E. Pippin
Prof. & Chairman, Dept. of Aviation
2160 W. Case Road
Columbus, OH 43210-0022
(614) 292-5593

University of Alaska Anchorage
Mr. Gary E. Cox
Associate Dean
3211 Providence Drive
Anchorage, AK 99508
(907) 786-4661

University of the District of Columbia
Mr. David Neel
Chairperson, Dept. of Aero. Tech.
4200 Connecticut Avenue, NW
Washington, D.C. 20008
(202) 282-7421

University of Maryland Eastern Shore
Mr. Abraham D. Spinak, Director
Airway Science Program
Princess Anne, MD 21853
(301) 651-2200

University of Nebraska at Kearney
Mr. Larry Carstenson
Director of Airway Science Program
West Center Building E202
Kearney, NE 68849
(308) 234-8570

University of Nebraska at Omaha
Mr. James E. Crehan
Aviation Institute
Omaha, NE 68182-0508
(402) 554-3424

University of North Dakota
Professor John Bridewell
Airway Science Coordinator
Box 8216 University Station
Grand Forks, ND 58202
(701) 777-3034

Utah State University
Dr. Maurice G. Thomas
Head, Dept. of Ind. & Tech. Ed.
Industrial Science 112E
Logan, Utah 84322-6000
(801) 750-1795

Western Michigan University
Mr. Thomas L. Deckard
AWS Coordinator
2043 Kohrman Hall
Kalamazoo, MI 49008
(616) 387-6586

Winona State University
Dr. George Bolon
Physics/Aviation
Johnson and Sanborn
Winona, MI 55987
(507) 457-5260

THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA) EDUCATION PROGRAMS

NASA makes available a wide range of educational services, teaching materials, programs and advice to students and educators. Their resources include aeronautics and space related technologies.

NASA's National Education Programs are carried out through NASA headquarters and the nine NASA field centers. NASA operates five educational program areas which are managed by their Education Division in the Washington headquarters. These five are:

- Elementary and Secondary
- Higher Education
- Technology and Evaluation
- Educational Publications
- Administrative Management

For detailed information on NASA's educational programs, one should write to one of the following, according to the particular program.

Elementary & Secondary Education Programs
Elementary and Secondary Branch
Education Division, Code FEE
NASA Headquarters
Washington, D.C. 20546

Higher Education Programs
Higher Education Branch
Education Division, Code FEH
NASA Headquarters
Washington, D.C. 20546

Technology Programs
Technology and Evaluation Branch
Education Division, Code FET
NASA Headquarters
Washington, D.C. 20546

Educational Publications
Educational Publications Branch
Education Division, Code FEP
Washington, D.C. 20546

Each NASA Field Center has a pre-college center educational program officer and a University Affairs Officer. For information about Education Programs and services specific to your region or state, get in touch with the appropriate office at the Field Center listed below:

STATES:		CONTACT:
Alaska Arizona California Hawaii Idaho Montana	Nevada Oregon Utah Washington Wyoming	NASA Ames Research Center Moffett Field, CA 94035

Connecticut Delaware District of Columbia Maine Maryland Massachusetts	New Hampshire New Jersey New York Pennsylvania Rhode Island Vermont	NASA Goddard Space Flight Center Greenbelt, MD 20771
Colorado Kansas Bebraska New Mexico	North Dakota Oklahoma South Dakota Texas	NASA Johnston Space Center Houston, TX 77058
Floida Georgia	Puerto Rico Virgin Islands	NASA Kennedy Space Center Kennedy Space Center, FL 32899
Kentucky North Carolina South Carolina	Virginia West Virginia	NASA Langley Research Center Hampton, VA 23665
Illinois Indiana Michigan	Minnesota Ohio Wisconsin	NASA Lewis Research Center Cleveland, OH 44135
Alabama Arkansas Iowa	Louisiana Missouri Tennessee	NASA Marshall Space Flight Center Huntsville, AL 35812
Mississippi		NASA John C. Stennis Space Center Stennis Space Center, MS 39529
All inquiries related to space and planetary exploration and other JPL activities		Jet Propulsion Laboratory 4800 Oak Grove Drive Pasadena, CA 91109

CIVIL AIR PATROL (CAP) - UNITED STATES AIR FORCE (USAF) CIVILIAN AUXILIARY

For more than fifty years Civil Air Patrol has made contributions to aviation and aviation education as an organization of adult and youth volunteer members. CAP has been a national leader in planning and conducting aviation and aerospace education workshops for teachers. CAP has developed aerospace education teaching materials of value to elementary and secondary schools. Many of CAP's educational materials are free. Others may be purchased at reasonable cost.

Aerospace educational materials are structured for school teahers and many of the materials are free of charge if requested on school letterhead. Following is a list of some of the educational materials available along with the list, addresses and states served by each of the eight CAP-USAF Liaison Region Directors of Aerospace Education (LR/DAE).

CAP AEROSPACE EDUCATION MATERIALS

General

Aeronautical Posters
Chronology of Aerospace Events Posters
Space Shuttle Posters
Jet Engine Posters
Aerospace Education Defined
Visual Aids for Teaching Aerospace Education
The Aerospace Curriculum: An Index of Related Topics
Educators Guide to DoD Aerospace Resources

Elementary Level

4-in-1 Activity Booklet One (K-3)
4-in-1 Activity Booklet Two (K-3)
Fun in Flight: Exploring Careers in the Aerospace World (K-6)
General James H. Doolittle Activity Booklet (3-6)
Amelia Earhart Activity Booklet (3-6)
Charles A. Lindbergh Activity Booklet (3-6)
Eddie Rickenbacker Activity Booklet (3-6)
Space Shuttle Activity Booklet (3-6)
Wilbur and Orville Wright Activity Booklet (3-6)

Junior High and High School Levels

General "Jimmy" Doolittle Packet
Amelia Earhart Packet
History of General Aviation Packet
Dr. Robert H. Goddard Packet
General Daniel "Chappie" James, Jr. Packet
Charles A. Lindbergh Packet
Major General William "Billy" Mitchell Packet
Captain Edward "Eddie" V. Rickenbacker Packet
Space Shuttle Packet
The Wright Brothers Packet

REGIONAL DIRECTORS OF AEROSPACE EDUCATION

GREAT LAKES LIAISON REGION

Illinois
Indiana
Kentucky
Michigan
Ohio
Wisconsin

CAP-USAF GLLR/DAE
(MCLGLR), Building 110
Wright-Patterson AFB, OH 45433-5000

NORTHEAST LIAISON REGION

Connecticut
Massachusetts
Maine
New Hampshire
New Jersey
New York
Pennsylvania
Rhode Island
Vermont

CAP-USAF NELR/DAE
2401 Vandenberg Avenue
McGuire AFB, NJ 08641-5105

NORTH CENTRAL LIAISON REGION

Iowa
Kansas
Minnesota
Missouri
Nebraska
North Dakota
South Dakota

CAP-USAF NCLR/DAE
760 Military Highway
Minneapolis, MN 55450-2000

MIDDLE EAST LIAISON REGION

Deleware
Maryland
District of Columbia
North Carolina
South Carolina
Virginia

CAP-USAF MELR/DAE
Building 3717, Stop 202
Andrews AFB, MD 20331-5000

PACIFIC LIAISON REGION

Alaska
California
Hawaii
Nebraska
Oregon
Washington

CAP-USAF PLR/DAE
Building 4579
Mather AFB, CA 95655-5000

ROCKY MOUNTAIN LIAISON REGION

Colorado
Idaho
Montana
Utah
Wyoming

CAP-USAF RMLR/DAE
Building 407, Det. 7
Lowry AFB, CO 80230-5000

SOUTHEAST LIAISON REGION

Alabama
Florida
Georgia
Mississippi
Tennessee
Peurto Rico

CAP-USAF SELR/DAE
Building 802
Dobbins AFB, GA 30069-5000

SOUTHWEST LIAISON REGION

Arizona
Arkansas
Louisiana
New Mexico
Oklahoma
Texas

CAP-USAF SWLR/DAE
P.O. Box 31 (Bldg. 1239)
NAS Dallas, TX 75211-9505

Civil Air Patrol publishes excellent Aerospace Education texts that are suitable for middle school and above and for high school magnet programs. The first one suitable for middle school and above is entitled: Aerospace: The Flight of Discovery, 1992. The second is entitled: Aerospace: The Challenge (3rd Edition), 1989. These materials are avialable by writing:

Headquarters CAP-USAF Bookstore
Maxwell AFB, AL 36112-5572

AEROSPACE EDUCATION CLASSROOM SUPPORT MATERIALS CATALOG

Civil Air Patrol maintains a large stock of items for sale for use by teachers and students of aviation and space. These items range from space toys, to model plane kits such as the Delta Dart, to hot air balloon kits and Estes model rocketry kits and supplies. A variety of video tapes, educational coloring books and story cassettes as well as aviation and space story books suitable for ages 7-9 are available. High quality posters, display photographs and desk models are available.

For a catalog of these excellent resources, write to:

Civil Air Patrol Supply Dept.
14400 Airport Blvd.
Amarillo, Texas 79111-1207

Important Note: These are not free materials. You may also be able to obtain a free copy of this catalog from your appropriate CAP-USAF Liaison Region Director of Aerospace Education (LR/DAE) see list above.

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

Many educators who realize the importance of weather and environmental studies make use of NOAA"s educational resources. For example, a recent NOAA publication is entitled: Educator's Guide for Building and Operating Environmental Satellite Receiving Stations, 1991. The manuscript for this publication was prepared by:

R. Joe Summers
Science Department
Chambersburg Area Senior High School
Chambersburg, PA 17201

Educators seeking information on the application of environmental satellite data in education should communicate with:

NOAA Educational Affairs
1825 Connecticut Avenue, NW
Suite 627
Washington, D.C. 20235
Telephone: (202) 606-4380
FAX: (202) 606-4425

NATIONAL AIR AND SPACE MUSEUM (NASM)
SMITHSONIAN INSTITUTION EDUCATION RESOURCE CENTER (ERC)

The Education Resource Center (ERC) of the National Air and Space Museum (NASM) is open to all teachers of all grade levels and disciplines. The ERC offers teachers access to educational materials relating to aviation, space and the museum's collections. These materials are produced by NASM, NASA, FAA and other governmental agencies and private organizations.

Among the resources available in the ERC are:

Curriculum packages - grades K-12
Lesson plans
Public domain software (compatible with Apple II and IBM PC computers)
Film Strips
Videos - for rent or purchase
ERC educator workshops
Tours and group reservations
"Skylines" Newsletter

For information write to:

Education Division, MRC 305
National Air and Space Museum
Washington, D.C. 20560

To obtain information by telephone:

ERC (202) 786-2109
Workshops (202) 357-1504
Tours and Groups (202) 357-1400

AVIATION ORGANIZATIONS PROVIDING INFORMATION, MATERIALS. AND SERVICES OF USE TO EDUCATORS AND STUDENTS

Many of these organizations have a record of years of working with students and teachers.

Academy of Model Aeronautics
1810 Samuel Morse Drive
Reston, VA 22090
(703) 435-0750
Provides information on building and flying model aircraft.

Aerospace Industries Association of America, (AIA)
1250 Eye Street, NW
Washington, D.C. 20005
202-371-8400
Provides information on aerospace manufacturing, including aircraft, missiles, spacecraft, helicopters and related equipment.

Air Line Pilots Association (ALPA)
535 Herndon Parkway
Herndon, VA 22070
(703) 689-2270
Provides educational, safety and pilot career information.

Air Traffic Control Association (ATCA)
220 North 14th Street, Suite 410
Arlington, VA 22201
(703) 522-5717
Provides information on national air traffic control.

Air Transport Association of America (ATA)
1709 New York AVenue, NW
Washington, D.C. 20006
(202) 626-4000
Provides information concerning the scheduled airline industry.

Aircraft Electronics Association (AEA)
P.O. Box 1981
Independence, Mo 64055
(816) 373-6565
Provides information on installation of avionics.

Aircraft Owners and Pilots Association (AOPA)
421 Aviation Way
Frederick, MD 21801
(301) 695-2000
Provides information on general aviation from the pilot's perspective, careers, regulations, safety and value of community airports.

American Institute of Aeronautics & Astronautics
370 L'Enfant Promenade, SW
Washington, D.C. 20024
(202) 646-7400
Promotes aeronautics and astronautics through educational material

Aviation Distributors & Manfuacturers Association (ADMA)
1900 Arch Street
Philadelphia, PA 19103
(215) 564-3484
Provides information on aviation products and publishes an aviation education newsletter.

Aviation Exploring Division - Boy Scouts of America
National Office
1325 Walnut Hill Lane
Irving, TX 75038-3096
(214) 580-2427
Provides information on national BSA aviation exploring program.

Aviation Maintenance Foundation Inc. (AMFI)
Box 2826
Redmond, WA 98073
(206) 828-3917
Provides vocational guidance, books and technical materials.

Aviation Technical Education Council (ATEC)
229 South 4th Street
Steelton, PA 17113
(717) 939-0620
Provides information on aviation maintenance technician training.

Beech Aircraft Corporation
Aviation Education
P.O. Box 85
Wichita, KS 67201
(316) 676-8839
Teacher workbook for elementary level, secondary course guide, special aircraft product packets for technical programs. Order form and description available.

with 6 posters and teacher's guide on function and role of airplanes. Order form on all items offered available.

Experimental Aircraft Association (EAA)
Wittman Field
Oshkosh, WI 54903-3086
(414) 426-4800
Provides information on sport and recreation aviation, aerobatics and how to restore old planes. Sponsors Young Eagles Program including Youth Sport Aviation magazine.

Future Aviation Professionals of America (FAPA)
4959 Massachusetts Blvd.
Atlanta, GA 30337
(800) 538-5627
Provides pilot and aviation career information.

General Aviation Manufacturers Association (GAMA)
1400 K Street NW, Suite 801
Washington, D.C. 20005
(202) 393-1500
Provides information on general aviation statistics, learning to fly, teaching units and career information.

Helicopter Association International (HAI)
1619 Duke Street
Alexandria, VA 22314-3406
(703) 683-4646
Provides general information on helicopters.

International Air Transport Association (IATA)
2000 Peel Street
Montreal, PQ, Canada H3A 4R4
Provides information on air transportation. Deals with air traffic and safety regulations.

Jeppesen Sanderson
55 Inverness Drive East
Englewood, CO 80112-5498
(303) 799-9090
Provides aviation education materials in the form of textbooks, videos, overheads and classroom support items.

National Agricultural Aviation Association
115 D Street, SE, Suite 103
Washington, D.C. 20003
(202) 546-5722
Promotes agricultural aviation through elementary and secondary Teacher Guides.

National Air & Space Museum
Office of Education
Washington, D.C. 20560
(202) 786-2106
Provides educational information on aviation and space activities.

National Air Transportation Association (NATA)
4226 King Street
Alexandria, VA 22302
(703) 845-9000
Provides informatin on airport service organizations (FBOs), air charter and flight training.

4-H Aerospace Education Program Leader
USDA Extension Service, Room 3860 South Building
Washington, D.C. 20250-0900
(202) 447-5516
Provides information on aerospace materials and state level 4-H aerospace program assistance.

National Association of State Aviation Officials (NASAO)
Metro Plaza One
8401 Colesville Road, Suite 505
Silver Spring, MD 20910
(301) 588-1286
Provides educational materials for all sectors of aviation, including an aviation education status report by state.

National Business Aircraft Association, Inc., (NBAA)
1200 18th Street, NW
Washington, D.C. 20036
(202) 783-9000
Promotes aviation-related interests of businesses, companies and individuals using aircraft for business.

National Intercollegiate Flying Association (NIFA)
Box 3207
Delta State University
Cleveland, MS 38733
(601) 846-4205
Promotes collegiate aviation education and safety.

National Transportation Safety Board
(NTSB)
Office of Public Affairs
490 L'Enfant Plaza East, SW
Washington, D.C. 20594
(202) 382-6600
Provides information on air traffic safety.

The Ninety-Nines, Inc.
Box 59965, Will Rogers World Airport
Oklahoma City, OK 73159
(405) 685-7969
Contributors to educational, charitable and scientific activities.

Professional Aviation Maintenance
Association (PAMA)
500 NW Plaza, Suite 809
St. Ann, MO 63074
(314) 739-2580
Educational materials on professional aircraft mechanics.

Soaring Society of America, Inc.
P.O. Box E
Hobbs, NM 88241
(505) 392-1177
Provides information on soaring and gliding.

University Aviation Association (UAA)
3410 Skyway Drive
Opelika, AL 36801
(205) 844-2434
Provides informatin on college level aviation curricula and schools.

Young Astronaut Council (YAC)
1308 19th Street, NW
Washington, D.C. 20036
(202) 682-1984
Provides educational packets to YAC chapters nationwide.

NATIONAL COALITION FOR AVIATION EDUCATION (NCAE)

On May 1, 1993 during the National Congress on Aviation & Space Education (NCASE) in Orlando, Florida, a partnership between industry, labor and government was formalized. This coalition was established as a partnership with the Federal Aviation Administration (FAA) and fourteen organizations.

The NCAE Mission Statement is as follows:

> The National Coalition for Aviation Education represents industry and labor, united to promote aviation education activities and resoures; increase public understanding of the importance of aviation; and support educational initiatives at the local, state and national levels.

The NCAE members have suggested to educators:

> If you are interestd in receiving NCAE Member Organization materials, please write to each coalition member individually. Each member handles its own material distribution.

Following is a list of the NCAE member organizations with a brief statement about each one along with the name of the person in each organization responsible for aviation education inquiries:

Aircraft Electronics Association (AEA)
Tyson Whiteside
AEA Educational Foundation, Inc.
P.O. Box 1963, Attn: Membership Services
Independence, MO 64055
(816) 373-6565/ FAX: (816) 478-3100
AEA represents over 900 FAA Part 145 Certified Repair Stations as well as most manuracturers of general aviation avionics equipment and airframes.

Aircraft Owners and Pilots Association (AOPA)
Janette Prince
Aircraft Owners and Pilots Association
421 Aviation Way
Frederick, MD 21701
(301) 695-2000/ FAX: (301) 695-2375
AOPA Represents more than 300,000 general aviation aircraft owners and pilots who use their aircraft for non-commercial personal and business transportation. AOPA members constitute 60 percent of the active pilots in the nation.

American Helicopter Society (AHS)
Norm Mowbray
American Helicopter Society
217 N. Washington Street
Alexandria, VA 22314-2538
(202) 637-3983/ FAX: (703) 892-0542
AHS is the professional society for the advancement of vertical flight technology and its useful application throughout the world.

Aviation Distributors and Manufacturers Association (ADMA)
Patricia Lilly
Aviation Distributors and Manufacturers Association
1900 Arch Street
Philadelphia, PA 19103
(215) 564-3484/FAX: (215) 564-2175
ADMA represents approximately 100 disbributors and manufacturers of aviation parts, components and suppliers.

EAA Aviation Foundation, Inc. Experimental Aircraft Association (EAA)
Chuck Larsen
EAA Aviation Center
P.O. Box 3065
Oshkosh, WI 54903-3065
(414) 426-4888/FAX: (414) 426-4873
The EAA Aviation Foundation is dedicated to the discovery and fulfillment of individual potential through opportunities and challenges inspired by the dream of personal flight. Its mission focuses upon education, on man's quest for flight and on research and innovation accomplished by individuals in aviation.

General Aviation Manufacturers Association (GAMA)
Shelly Snyder
General Aviation Manufacturers Association
1400 K. Street, N.W., Suite 801
Washington, D.C. 20005-2485
(202) 383-1500/FAX: (202) 842-4063
GAMA represents 48 U.S. manufacturers of general aviation aircraft, engines, avionics and related equipment. GAMA promotes a better understanding of the air transportation environment and the important role general aviation plays in the national economy and serving America's transportation needs.

Helicopter Association International (HAI)
Norm Mowbray
Helicopter Association International
1619 Duke Street
Alexandria, VA 22314-4646
(202) 637-3893/ FAX: (703) 892-0542
HAI is a non-profit professional trade association with over 1,100 member organizations in 51 nations. HAI is dedicated to promoting the helicopter as a safe and efficient method of transportation.

International Association of Machinists and Aerospace Workers (IAMAW)
John Goglia
International Association of Machinists
Transportation Department
9000 Machinists Place
Upper Marlboro, MD 20772-2687
(301) 967-4558/ FAX: (617) 233-7777
IAMAW is the largest labor organization representing air transportation in the United States including professional aircraft maintenance and manufacturing personnel.

National Aeronautic Association (NAA)
Raymond J. Johnson
National Aeronautic Association
1815 N. Fort Meyer Drive, Suite 700
Arlington, VA 22209
(703) 527-0226/ FAX: (703) 527-0229
NAA's purpose is to coordinate and promote sport aviation within the United States; to represent sport aviation internationally; to oversee the establishment of all aviation and space records set in the U.S. and to promote aviation through national recognition of individual achievement.

National Air Transportation Association (NATA)
Dr. Mervin K. Strickler, Jr.
National Air Transportation Association
4226 King Street
Alexandria, VA 22302
(703) 845-9000/ FAX: (803) 845-8176
NATA represents the business interest of the nation's general aviation service companies providing fueling, flight training, maintenance and repair and on-demand charter service by more than 1,700 member companies with more than 100,000 employees.

National Association of State Aviation Officials/Center for Aviation Research and Education (NASAO/CARE)
Edward M. Scott
NASAO/CARE
Metro Plaza One
8401 Colesville Road, Suite 505A
Silver Spring, MD 20910
(301) 588-0587/ FAX: (301) 588-1288
NASAO represents the state government aviation service agencies in all the states, as well as the aviation departments of Puerto Rico and Guam.

National Business Aircraft Association (NBAA)
Cassandra Bosco
National Business Aircraft Association
1200 18th Street
N.W., Suite 200
Washington, D.C. 20036
(202) 783-9000/ FAX: (202) 862-5552
NBAA represents the interests of over 3,200 companies which operate general aviation aircraft as an aid to business. NBAA members earn annual revenues in excess of $3 trillion and employ more than 16 million people worldwide.

Opportunity Skyway
Carlton Spitzer
6709 Cpl. Frank S. Scott Drive
College Park, MD 20740
(301) 864-0673/ FAX: (301) 864-0849
Opportunity Skyway is a national aviation-oriented drop-out prevention, career development program focused chiefly but not exclusively on preparing minority and disadvantaged youngsters for the workplace.

Professional Aviation Maintenance Association (PAMA)
David S. Wadsworth
Professional Aviation Maintenance Association
500 Northwest Plaza, Suite 401
St. Ann, MO 63074
(314) 739-2580/ FAX: (314) 739-2580
PAMA is a national professional association of aviatio maintenance technicians, with some 4,000 individual members and 250 affiliated company members.

Federal Aviation Administration (FAA) (In partnership with NCAE)
Phillip S. Woodruff
Division Manager, AHT-100
Federal Aviation Administration
Aviation Education Division Pl.100
Washington, D.C. 20590
In addition to FAA's regulatory role in licensing pilots, maintenance, etc., FAA provides a variety of aviation education materials and advice, ranging from kindergarten to the university level.

SELECTING TEXTS, REFERENCES AND TEACHING MATERIALS FOR AVIATION MAGNET PROGRAMS

Many of the programs described earlier in the publication refer to various texts and references. Civil Air Patrol's publications have already been described. According to the Aviation Magnet School Survey reported earlier, those magnet schools that taught flying used the Jeppesen Sanderson text more than any other. Following is a listing of the Table of Contents of the popular text: Aviation Fundamentals, 1992 Edition, published by:

Jeppesen Sanderson, Inc.
55 Inverness Drive, East
Englwood, Colorado 80112-5498
Telephone: (303) 799-9090

This publication has available a series of eight video tapes that serve as teaching aids for the chapters noted.

Preface

Chapter 1 Principles of Flight
Section A Airplanes
Section B Four Forces of Flight
Section C Aerodynamics of Maneuvering Flight
Section D Stability
Corresponding Video - Volume 1

Chapter 2 The Flight Environment
Section A Safety of Flight
Section B Airports
Section C Airspace
Section D Radio Communications
Section E Radar and ATC Services
Corresponding Video - Volume 2

Chapter 3 Aircraft Systems and Performance
Section A Pitot-Static Instruments
Section B Gyroscopic Instruments
Section C Engine and Propeller
Section D Fuel and Electrical Systems
Section E Predicting Performance
Section F Weight and Balance
Corresponding Video - Volume 3

Chapter 4 Meteorology for Pilots
Section A Basic Weather Theory
Section B Weather Patterns
Section C Weather Hazards
Corresponding Video - Volume 4

Chapter 5 Interpreting Weather Data
Section A Printed Reports and Forecasts
Section B Graphic Weather Products
Section C Sources of Weather Information
Corresponding Video - Volume 5

Chapter 6 Basic Navigation
Section A Aeronautical Charts
Section B Flight Computers
Seciton C Pilotage and Dead Reckoning
Section D Sources of Flight Information
Corresponding Video - Volume 6

Chapter 7 Radio Navigation Systems
Section A VHF Omnidirectional Range
Section B Automatic Direction Finder
Section C Advanced Navigation
Corresponding Video - Volume 7

Chapter 8 Aviation Physiology
Section A Vision in Flight
Section B Spatial Disorientation
Section C Respiration and Altitude
Section D Alcohol, Drugs and Performance
Corresponding Video - Volume 8

Chapter 9 Flight Planning and Decision Making
Section A Planning and Organizing Flights
Section B Factors Affecting Decision Making
Corresponding Video - Volume 9

Chapter 10 Aviation History
  Section A The Quest for Flight
  Section B World War I
  Section C The Golden Age
  Section D World War II
  Section E The Jet Age

Chapter 11 The Nature of Space
  Section A The Earth's Atmosphere
  Section B Characteristics of Space
  SEction C The Solar System
  Section D The Universe

Chapter 12 Rockets and Space Flight
  Section A History of Rocketry
  Section B The Space Age
  Section C Rocket Propulsion
  Section D Orbital Mechanics

Chapter 13 Careers in Aviation and Aerospace
  Section A Flight Crew
  Section B Nonflying Careers
  Section C Getting Started in Aviation

Appendix A Plotter and Wind Triangles
Appendix B Glossary
Appendix C Abbreviations
Index
Notams

FOR MODEL ROCKETRY MATERIALS:

Estes Industries/Hi Flier Manufacturing Co.
P.O. Box 227
1295 H Street
Penrose, CO 81240

Estes Industries are known world-wide for the design, manufacture and sale of safe, educationally sound materials and study guides for the use of model rocketry in education. Educators may write for their manual and catalog of materials.

TECHNOLOGY EDUCATION MATERIALS:

Pitsco - The Technology Education Company
P.O. Box 1707
Pittsburg, KS 66762
(800) 828-5787

Pitsco publishes a comprehensive catalog of materials for a wide range of teaching science and technologies including aviation and rocketry. The Learner Outcomes described in the Section of this publication which told of the middle school programs in Loudon County, Virginia were prepared by Synergistic Systems, a Pitsco company.

MAGNET SCHOOL ORGANIZATION:

The growth of the movement to plan magnet programs at all grade levels and with myriad themes such as described throughout this publication, has led to the formation of a national organization. For information about this important professional organization, communicate with:

Dr. Donald R. Waldrip
Executive Director
Magnet Schools of America
College of Education
University of Houston
401 Farish Hall
Houston, TX 77204-5874

The foregoing sources of information, advice, publications, materials are illustrative of the many places an educator or volunteer may turn to for assistance in planning a meaningful aviation education or manget program. It should be realized that these are not all of the resources. They are, however, a good place to start.

BIBLIOGRAPHY

__________, *Aerospace Education Defined, a programmed learning exercise*, Civil Air Patrol National Headquarters, Maxwell Air Force Base, Alabama, 36112-5572, 1986.

__________, *Airway Science Curriculum Proposal - Proposal Information and Instructions*, Section One (Advance Copy), Federal Aviation Administration, Washington, D.C., January, 1993.

Bacon, Harold R., Schrier, Michael D., McGill, Patricia F., Hellinga, Gerald D., *Aerospace: The Challenge*, (Third Edition), Civil Air Patrol National Headquarters, Maxwell Air Force Base, Alabama, 1989.

Bergstrom, Dr. Scott J., *Distance Education for the Airway Sciences: Promises and Challenges*, Report Delivered at Dowling College Transportation Forum, January 7, 1993.

Blank, Rolf K., Dentler, Robert A., Baltzell, D. Catherine, Chabotar, Kent, *Survey of Magnet Schools - Analyzing A Model for Quality Integrated Education*, Prepared by James H. Lowry and Associates, Abt Associates, Inc., Subcontractor, Final Report of a National Study for U.S. Department of Education, Office of Planning, Budget and Evaluation, Contract No. 300-81-0420, September, 1983.

Bondurant, Jr., Dr. R. Lynn, Olson, Curt, Peterson, Pamela K., *Sauk Rapids High School - Secondary Aerospace and Applied Technology Business - Education Partnership*, Sauk Rapids, Minnesota, Second Draft, 1991.

Busey, Admiral James B., FAA Administrator, *Aviation Education Policy Statement*, Washington, D.C., 1991.

Busey, Admiral James B., FAA Administrator, *Remarks Before Aerospace Education Center*, Little Rock, Arkansas, April 12, 1991.

Conway, Lee,"Classroom in the Sky: A Power Trip for Disadvantaged Youth," *Phi Delta Kappan*, May, 1976.

Crain, Robert L., Heebner, Amy L., Si, Yiu-Pong assisted by Jordan, Will J., Kiefer, David R., Teachers College, Columbia University, *The Effectiveness of New York City's Career Magnet Schools: An Evaluation of Ninth Grade Performance Using An Experimental Design*, National Center for Research in Vocational Education, University of California at Berkeley, 1995 University Avenue, Suite 375, Berkeley, California 94704, Study Supported by the Office of Vocational and Adult Education, U.S. Department of Education, April, 1992.

BIBLIOGRAPHY (Cont'd)

Estes, Nolan, Levine, Daniel U, Waldrip, Donald R., Magnet Schools Recent Developments and Perspectives, Morgan Printing & Publishing, Inc., 900 Old Koenig Lane, Suite 135, Austin, Texas 78756, 1990.

_________, Federal Register/Volume 48, No. 137/Friday, July 15, 1983/Notices, Office of Personnel Management, Demonstration Project: Airway Science Curriculum.

Goldberg, Isadore, Randall Aerospace and Marine Science Project (RAMS) An Evaluation Study, An Aviation Education Publication, U.S. Department of Transportation, Federal Aviation Administration, Washington, D.C., September, 1977.

Helmick, Edward F. and Davis, Lewis, Mastering Flying Basics in the Simulator Or How to Reduce the Cost of the Private Pilot Certificate, Frasca International, Inc., 906 East Airport Road, Urbana, Illinois, 61801, November 18, 1991.

Pentti, Frank W., Deputy Director, Office of Intermodal Transportation, U.S. Department of Transportation, Address to New York Chapter, Transportation Research Board, November 5, 1992.

Powell, Margaret L., Manager, Airway Science Curriculum Project, Information Paper: Airway (AWS) Curriculum Program, Federal Aviation Administration, Office of Training and Higher Education, 400 7th Street, SW, PL-100, Washington, D.C. 20590, February, 1993.

Preston, Edmund, Agency Historian, Federal Aviation Administration, Information Provided from the Draft Revision to the FAA Historical Fact Book in letter to Dr. Mervin K. Strickler, January 19, 1993.

_________, Public Law 100-297 - April 28, 1988, Title III - Magnet Schools Assistance, 20 USC 3023.

Racosky, Major Richard J. "Rico" (ANG), dreams + action = Reality Programs, 1992, Actiongraphics Publishing, International, P.O. Box 186, Mount Clemens, Michigan 48046-0186.

Rivera, Fanny, Remarks, at Second Annual Aviation Magnet School Conference, Phoenix, Arizona, November 20, 1992.

Simpson, Dr. Ronald P., Letter to Dr. Mervin K. Strickler, Jr., March 23, 1993, reporting that the first phase of the National Magnet School Survey is completed, Kansas City, Missouri. Report to be published by Magnet Schools of America, College of Education, University of Houston, 401 Farish Hall, Houston, TX

BIBLIOGRAPHY (Cont'd)

Smith, Maxine, Information Packet on Castlemont Aviation High School Program, Oakland, California, November, 1992.

Strickland, Patricia, The Putt-Putt Air Force - The Story of the Civilian Pilot Training Program and the War Training Service - 1939-1944, published by Aviation Education Staff, U.S. Department of Transportation, Federal Aviation Administration, Washington, D.C., 1970.

Strickler, Jr., Mervin K., Background Paper for First National Leadership Institute on Aerospace Education Magnet Schools, Aerospace Magnet Schools - Past - Present - Future, Little Rock, Arkansas, November 21, 1991.

Strickler, Jr., Mervin K., (Editor), An Introduction to Aerospace Education, New Horizons Publishers, Inc., Chicago, 1968. Chapter 2: The Scope of Aerospace, Raymond J. Johnson and Jean F. Blashfield. Aerospace Education History Material is Adapted From Chapter 19: History of Aerospace Education, by Mervin K. Strickler, Jr.

Strickler, Jr., Mervin K., and Dobson, Charles L., Learning Through Aviation, Prepared for Publication for the George R. Wallace Research Center, Embry-Riddle Aeronautical University, Daytona Beach, Florida and also published by: Office of General Aviation, Federal Aviation Administration, May, 1978.

Studebaker, John W., and Hinckley, Robert H., Air-Conditioning Young America, published by Civil Aeronautics Administration (CAA), U.S. Department of Commerce and U.S. Office of Education, Federal Security Agency, May, 1942.

__________, U.S. Department of Transportation (DOT), Federal Aviation Administration (FAA), Office of Public Affairs, Aviation Education Program, A Model Aerospace Aviation Curriculum Based on August Martin High School, Manuscript By: Dr. Mervin K. Strickler, Jr., Washington, D.C. (Developed For FAA in Conjunction with the Center For Aerospace Education Development, Civil Air Patrol Headquarters, Maxwell Air Force Base, Alabama, Originally Published 1980, Reprinted by FAA, 1991.

__________, U.S. Department of Education, Office for Civil Rights, Washington, D.C. 20202-1100, Magnet Schools: Promoting Equal Opportunity and Quality Education, May, 1991.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1993 -- 301-719 / 95790